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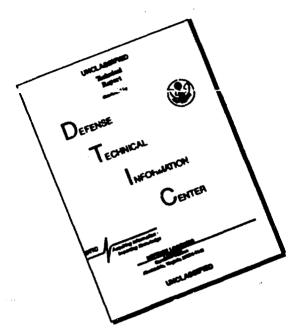
13. ABSTRACT (Maximum 200 words) The theme of the Advance Planning Briefing for Industry is "The Army Research Laboratory - Providing Technology for the Soldier." The objectives of the Advance Planning Briefing for Industry are to: a. Introduce the U.S. Army Research Laboratory (ARL); b. Present technologies in which ARL has an interest and is planning to pursue for the mid-and long term; c. Show planning budgets for these new technologies; e. Give the private sector and the academic community a preview in order to make sure that industrial and academic research and development investments coincide with the needs of the U.S. Army; f. Give the private sector and the academic community an opportunity to meet with the directorate executives, engineers and scientists who are responsible for the ARL business areas and are working on the new technologies. This briefing was designated for industry executives and academic research manager in-

volved in advance planning along with scientific and engineering management responsible for cooperative and independent R&D efforts.

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The **Army Research Laboratory** presents

Proceedings of the Advance Planning Briefing for Industry

Providing Technology to the Soldier

DTIC QUALITY INSPECTED 2

at the US Naval Surface Warfare Center White Oak, Md 27–28 January 1993

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U.S. ARMY RESEARCH LABORATORY (ARL) ADVANCE PLANING BRIEFING FOR INDUSTRY (APBI) 27-28 JANUARY 1993 NAVAL SURFACE WARFARE CENTER AUDITORIUM WHITE OAK, MARYLAND

27 JANUARY 1993		
4:00-6:00	Early Registration Maryland Inn-Laurel Laurel, Maryland	
6:00-8:00	Reception Maryland Inn-Laurel	
28 JANUARY 1993		
7:00-9:00	Registration Naval Surface Warfare Center, White Oak, Maryland	
7:50	Administrative Remarks	Mr. Melvyn J. Shichtman, Technical and Industrial Liaison Officer
8:00-8:05	Welcome	COL William J. Miller, Deputy Director, U.S. Army Research Laboratory
8:05-8:25	Keynote, Reshaping Our Business	LTG Leo J.Pigaty, Deputy Commander, U.S. Army Materiel Command
8:25-8:45	Battle Labs - The User's Perspective on Technology	COL William D. Hubbard Director, Battle Lab Integration and Technology Directorate, U.S. Army Training and Doctrine Command
8:45-9:15	ARL Overview	Mr. Bruce M. Fonoroff Directorate Executive, Advanced Concepts and Plans (ACAP)
9:15-9:45	Interfacing with ARL	Dr. Alan J. Goldman, Chief, Technology Transfer Division, Advanced Concepts and Plans Directorate

Dr. John Prasier,

Directorate Executive, Weapons Tachnology

9:45-10:00

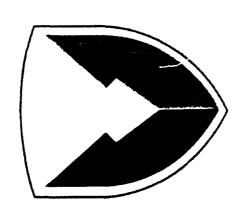
10:00-10:30

Break ·

Weapons Technology

10:30-11:10	Sensors, Signatures, Signal and Information Processing and Battlefield Combat Identification	Mr. Richard D. Slife Assistant Director for Programs, Sensors, Signatures, Signal and Information Processing
11:10-11:40	Materials	Mr. Lawrence D. Johnson Directorate Executive, Materials
11:40-12:10	Vehicle Propulsion	Mr. George A. Bobula, Directorate Executive (acting), Vehicle Propulsion
12:10-12:40	Battlefield Environment	COL Ronald Evans, Directorate Executive, Battlefield Environment
12:40-1:45	Lunch	
1:45-2:15	Electronics and Power Sources	Dr. Clare Thornton, Directorate Executive, Electronics and Power Sources
2:15-2:45	Human Research and Engineering	Dr. Robin L. Keesee, Directorate Executive, Human Research and Engineering
2:45-3:15	Vehicle Structures	Dr. Wolf Elber, Directorate Executive, Vehicle Structures
3:15-3:30	Break	
3:30-4:00	Advanced Computational and Informational Science	Dr. Andrew Mark Chief (acting), Simulation Technology Division, Advanced Computational and Informational Science Directorate
4:00-4:30	Survivability/Lethality Analysis	Dr. Jack Wade, Directorate Executive (acting), Survivability/ Lethality Analysis
4:30-4:45	Wrap up	COL Miller

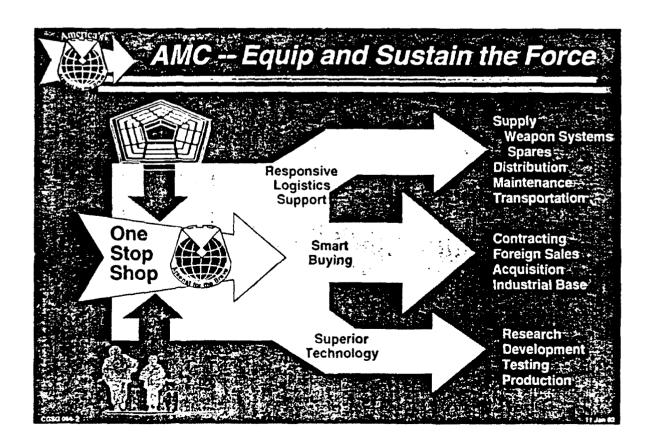
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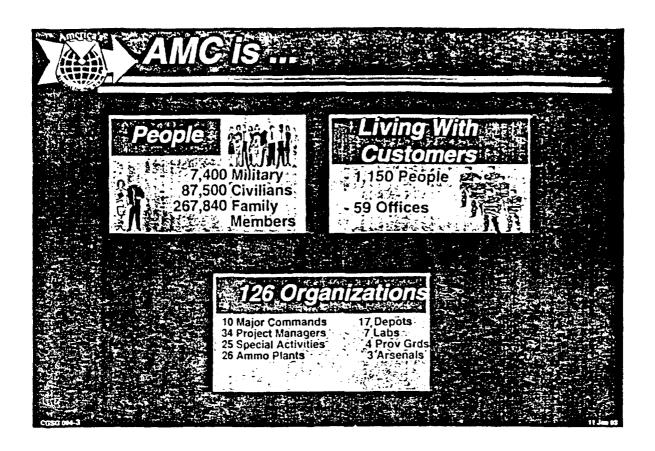


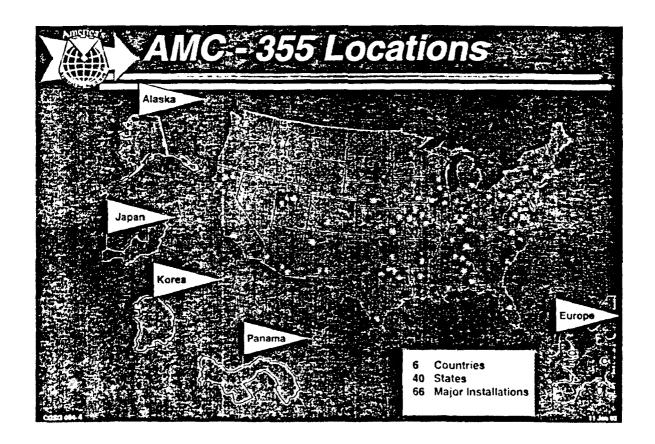
KEYNOTE ADDRESS Reshaping Our Business

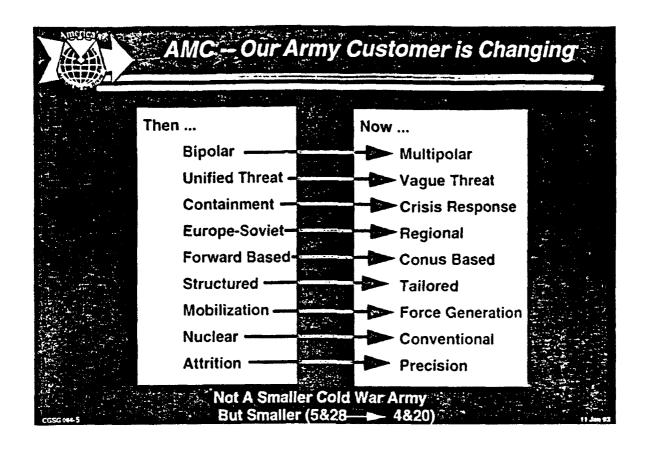
LTG Leo J. Pigaty Deputy Commander U.S. Army Materiel Command

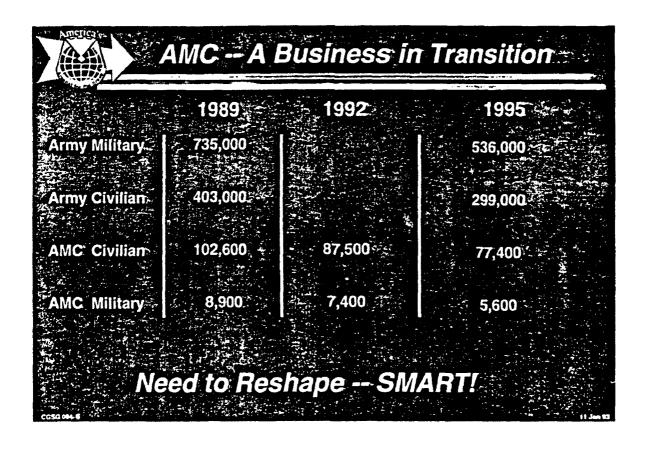




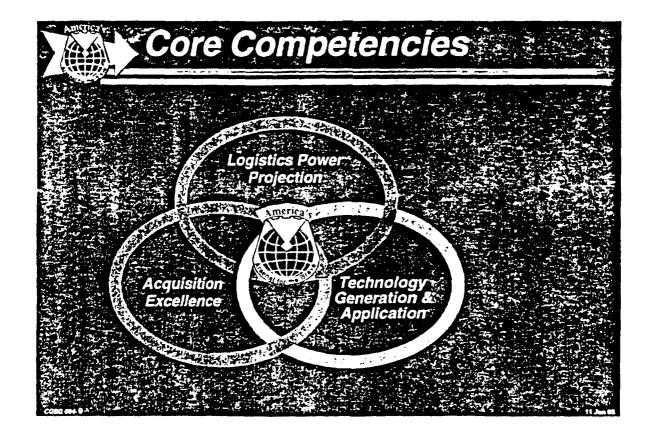


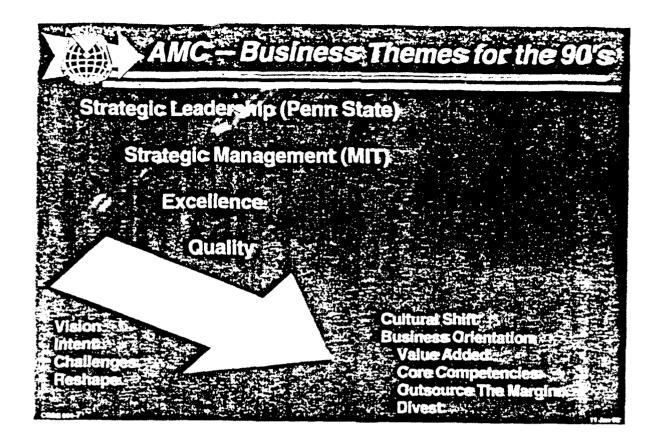


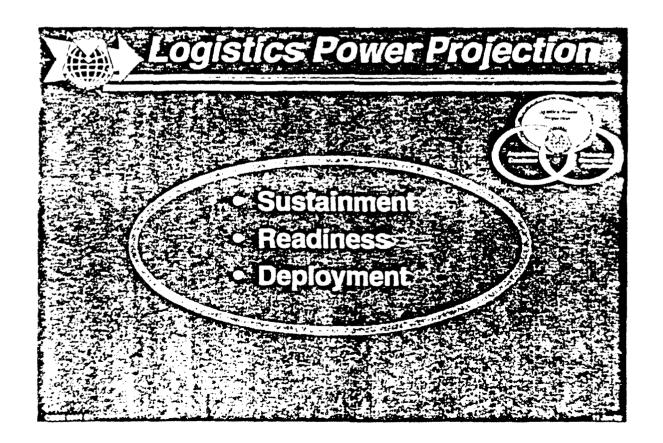




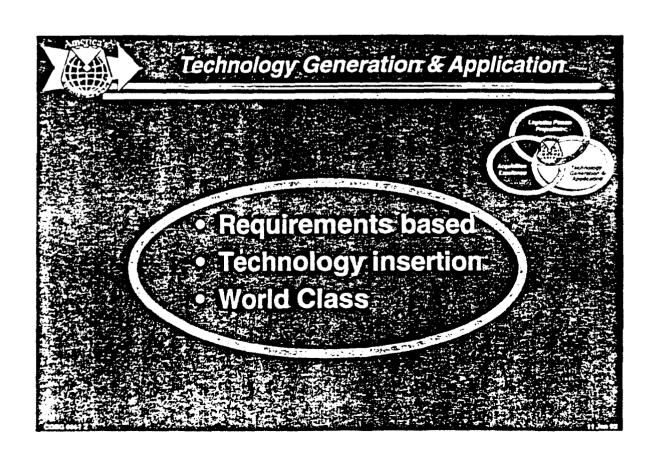
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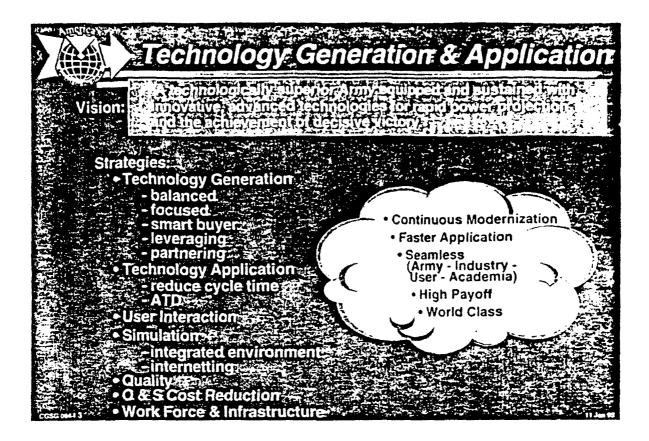


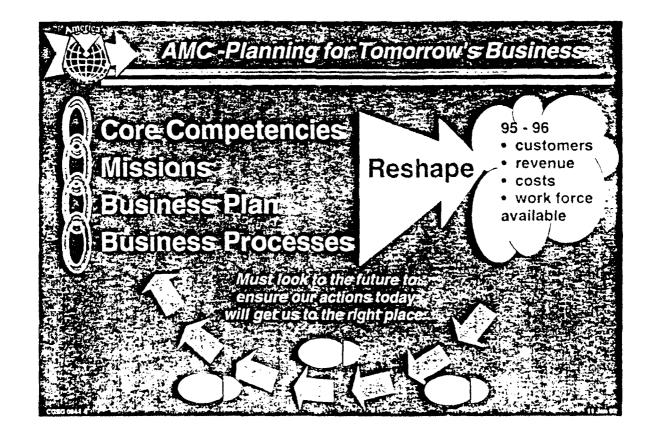


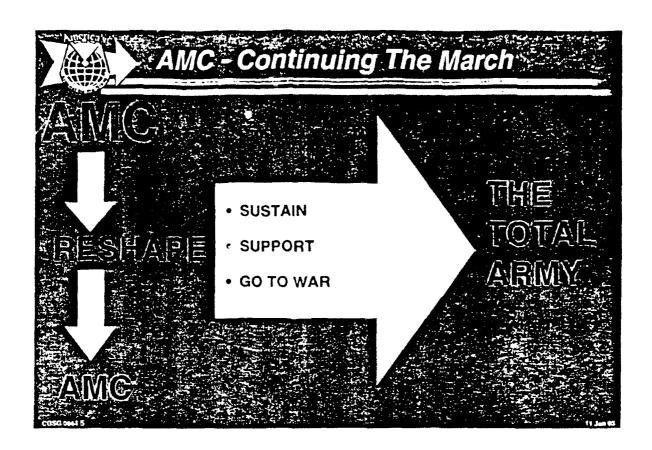










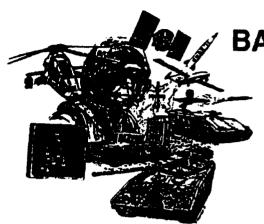


COMMAND DOCTR Ø T R A - N - N G



The User's Perspective on Technology

COL Willam D. Hubbard
Director, Battle Lab
Integration and Technology Directorate,
U.S. Army Training and Doctrine Command
(804) 728-5850



BATTLE LABS

-AN OVERVIEW-

MAINTAINING THE EDGE

CONTEXT FOR CHANGE

- STRATEGY/DOCTRINE
 FORCE PROJECTION STRATEGY
 GLOBAL RESPONSIBILITY
 AMBIGUOUS SCENARIOS
 LOW TO HIGH TECH THREAT
 DYNAMICS OF BATTLE IN TRANSITION
 MIXED AC/RC FORCE

- RESOURCES
 REDUCED DEFENSE RESOURCES
- MOST DOD SAT DOLLARS ARE
 MOST DOD SAT DOLLARS ARE
 NOT SERVICES'
 DEFENSE RAD DOWN 30% BY 1997
 MAJOR INVESTMENT IN EXTANT FLEET
 NEED TO REDUCE 048 COSTS

- MODERNIZATION
 TECHNOLOGICAL OPPORTUNITIES

- NEED TO MODERNIZE
 FEWER NEW STARTS
 CURRENT PROCESS ALLOWS
 FLEXIBILITY...BUT UNTESTED

SOLDIERS-LEADERS

AN ELITE FORCE OF TRAINED & READY SOLDIERS AND LEADERS WITH UNLIMITED CAPACITY TO RAPIDLY MASTER CHANGES IN:

- DOCTRINE EQUIPMENT TACTICS



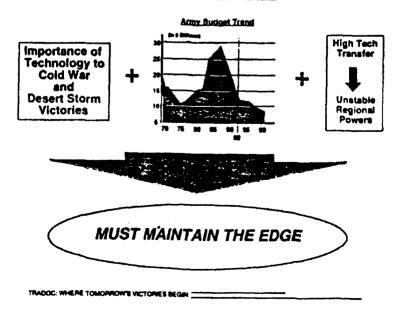
TRADOC: WHERE TOMORROW'S VICTORIES BEGIN

TRADOC ANALYSIS OF THE FUTURE BATTLEFIELD

FACTOR	IMPACT	IMPLICATIONS
• Farce Projection	Early vulnerability Greater unpredictability	·
Hi lethality indirect (precision) direct Extended range indirect direct	Battles finish faster - higher lamps Class III drives LOG - not ClassY Close at extended rangs Reduced cassualties (7)	Greater early entry letholity & survivability required
• Improved Intelligence	Deal a knock-out bloor increased vulnerability at depth importance of RSTA/counter RSTA	Evolving nation of Depth & Simulaneous Attack
• Improved C2	Tate the initiative - freeze the enemy Reduced reaction time Improve synchronization Temptation to controlize Temptation to controlize	• Expending builds
• Lower force density	Increased opportunity to avoid close battle: Interpenetration, flanking Greater scope for initiative Greater reliance on quality soldiers	space - Continuing the Natoric trend
• Weepons of mass destruction	Possibility of cutestrophic losses from single engagement Limits ability to concentrate forces Presses for geographic expension Greater threat from mobile TBMS	Controlling the Tempe of the fight - C2 on the move
· CNN/broadcast news	Links political and factical echsions Become a point of leverage by both sides	 Sustaining the fight CSS

TRADOC: WHERE TOMORROW'S VICTORIES BEGIN

OUR CHALLENGE



THE ARMY'S RESPONSE

- AN APPROACH THAT FITS OUR ARMY -



BATTLE LABS - - A means to develop capabilities for a Force Projection Army that begins where BATTLE APPEARS TO BE CHANGING and that encourages experimentation via simulations or prototypes to determine technology insertion or new requirements

SUCCESSFUL PRECEDENTS

- HOWZE BOARD
- 11TH AIR ASSAULT
- TRICAP
- 9TH DIV TEST BED
- 2 AD NIGHT EXPERIMENTS

Early Entry with increased Lethality and Survivability

Depth & Simultaneous Attack

- Battle Space Battle Command
- Combat Service Support

TRADOC: WHERE TOMORROW'S VICTORIES BEGIN

BATTLE LAB GENESIS APPROACH Warfighting Ide Doctrine 1 9 5 SCOPE gecific battle: dynamic lightportal integration Sale Thrusts linkage Varighting at all schelons Lechnology insertion Sanior leader GANIZATION nvolvement dvanced opn'l

PROCESS

- Conceptualize Analyze
- · Simulate
- Experiment
- Evaluate
- Prioritize

SOLUTIONS

Expressed in terms of:

- Doctrine
- Training
- Leadership
- Organizations
- Materiel
- Soldiers

BENEFITS

- · Brings together users,
- S&T, & other players Louisiana Maneuvers interface

BATTLE LARS

ESTABLISHED

MAY 92

AMC SUPPORT TO BATTLE LABS





BATTLE LAB

LEAD ROEC

+ |

SUPPORTING ALL BATTLE LASS

EARLY ENTRY

MISSILE

ARMY RESEARCH LABORATORIES (ARL)

MOUNTED
DISMOUNTED

NATICK

ARMY RESEARCH

DEEP & SIM ATTACK

ARMAMENTS

OFFICE (ARO)

BATTLE COMMAND

COMMUNICATIONS & ELECTRONICS

TANK & AUTOMOTIVE

AVIATION RDEC
EDGEWOOD RDEC

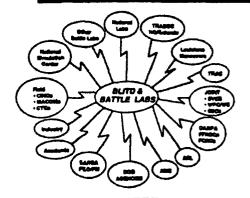
STRICOM

CSS

BELVOIR

TRADOC: WHERE TOMORROW'S VICTORIES BEGIN

BATTLE LAB COMMUNICATIONS NETWORKING

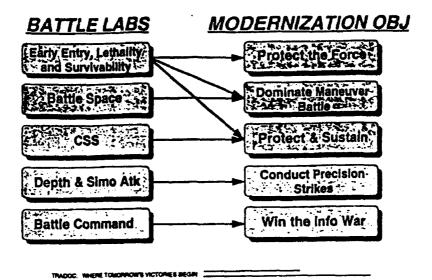




- Electronic Interconnection is key
 - Remote access to joint models and simulations
 - Virtual prototyping with industry and academia
 - Support to Louisians Mansuvers
- DSI is critical link

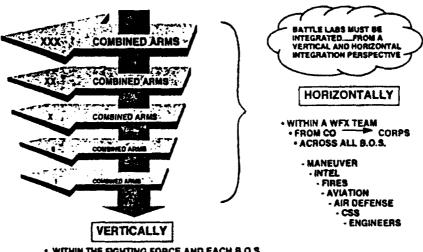
TRADOC WHERE TOMORROW'S VICTORIES BEGIN

ARMY MODERNIZATION VISION BATTLE LAB LINKS



INTEGRATION - KEY

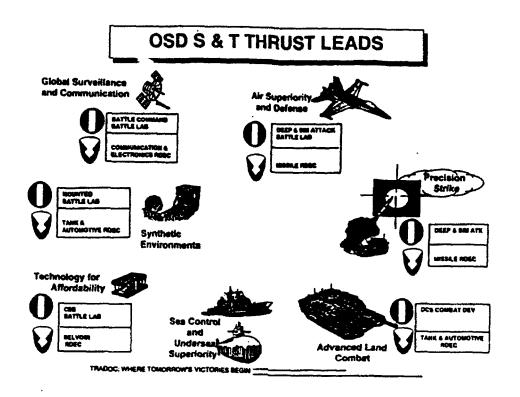
AS A FORCE WE FIGHT AS AN INTEGRATED COMBINED ARMS TEAM

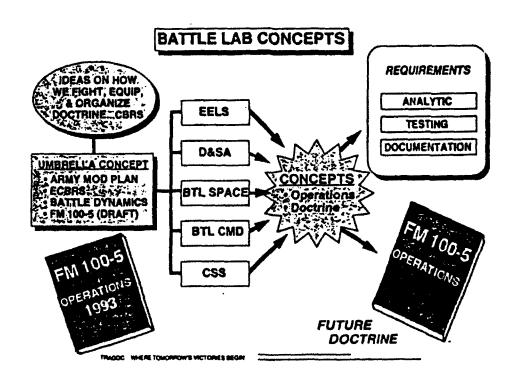


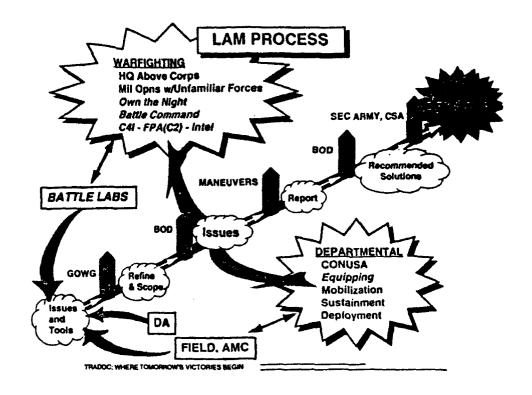
WITHIN THE FIGHTING FORCE AND EACH B.O.S.
 TAILOR, REORGANIZE, RESUPPLY, REALIGN
BETWEEN ECHELONS

. NESTED INTENTS WITHIN A UNIFIED CONCEPT

TRADOC: WHERE TOMORROWS VICTORIES MILLIN







BATTLE LABORATORY

PROVIDE OPPORTUNITIES FOR

- INTEGRATED REQUIREMENTS AND DEVELOPMENTS
 - . INTEGRATE MULTIPLE BATTLEFIELD OPERATING SYSTEMS

 - SIMULATION
 PROTOTYPING
 EXPERIMENTATION & TESTING
 EVALUATION
- ✓ MATERIEL DEVELOPER PARTICIPATES IN REQUIREMENTS DEFINITION
 - · INDUSTRY
 - · ACADEMIA
- **✓** FREEDOM TO EXPLORE
 - . CREATIVITY & INNOVATION

 - LEVERAGE TECHNOLOGICAL OPPORTUNITIES
 AVOID SUFFOCATION AND ATROPHY BY BUREAUCRATS



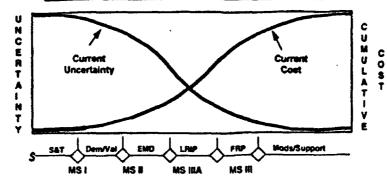
RISK REDUCTION OPPORTUNITIES FOR RDA PROCESS

PRODUCES

SMART & AFFORDABLE ALTERNATIVES

TRADOC, WHERE TOMORROW'S VICTORIES BEGIN





Cost of Change

TWADOC: WHERE TOMORROW'S VICTORIES BEGIN

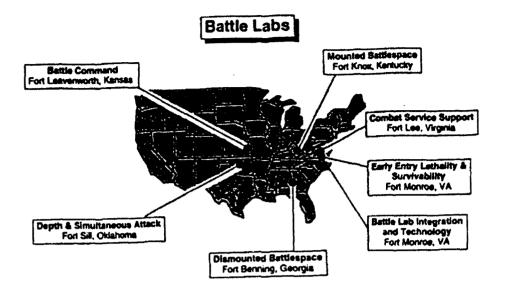
AVENGER

An Example of Historical Experimentation

- . Existing chassis HMMWV
- Existing weapon system Stinger
- Integrated Mount and Advanced FLIR
- Expedited Acquisition Process
 - Contractor built prototype for 9ID / ADEA using off-the-shelf components in Army inventory... documentation, spares and manufacturing costs significantly reduced

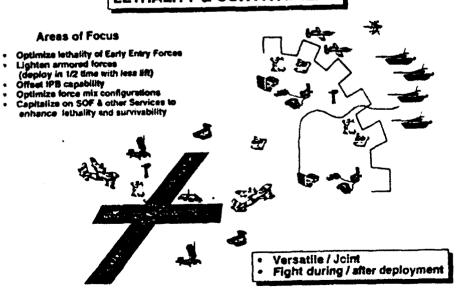
 - Milestone IIIA to fielding in 36 months (no milestone 0 thru III)

TRADOC, WHERE TOMORROW'S VICTORIES BEGIN



TIMADOC WHERE TOMORROW'S VICTORIES BEGIN

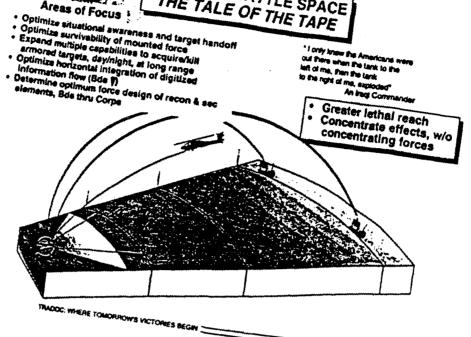
EARLY ENTRY LETHALITY & SURVIVABILITY

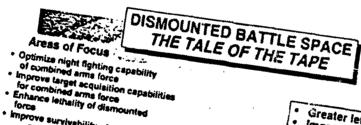


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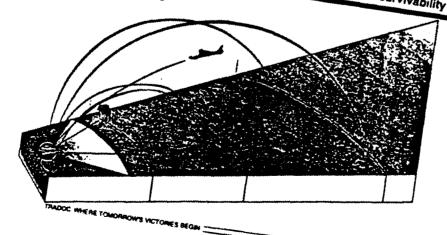
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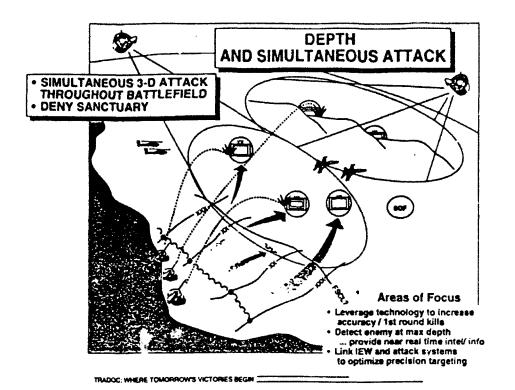


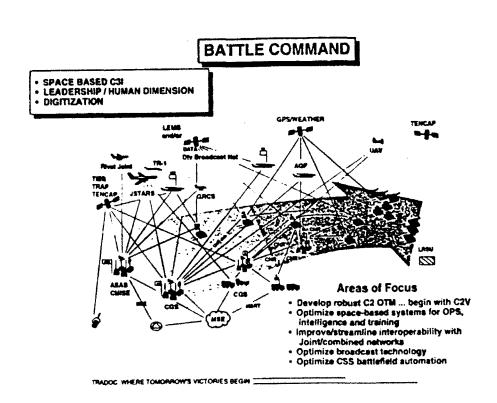


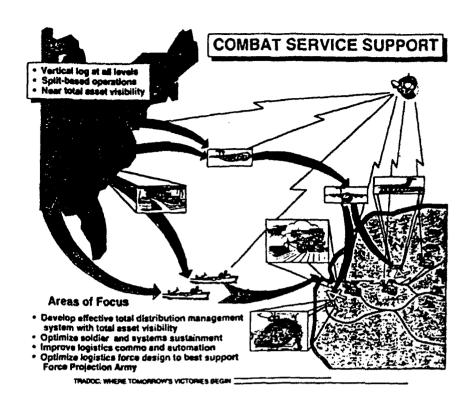
- Improve survivability of soldiers

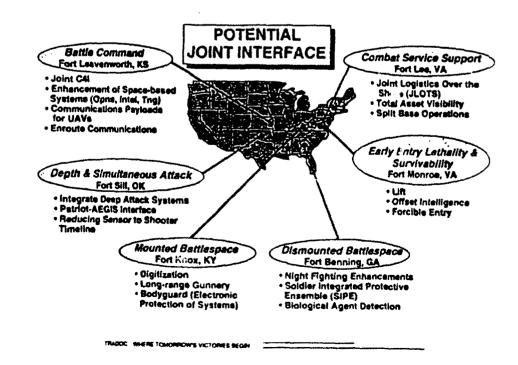
Greater lethality Improved survivability

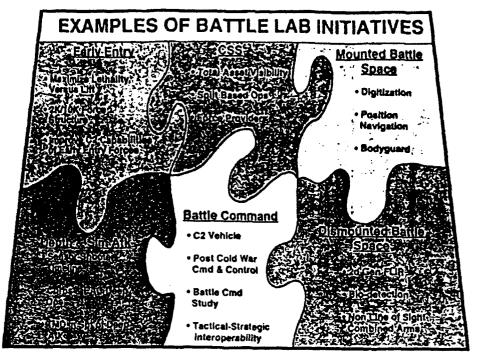




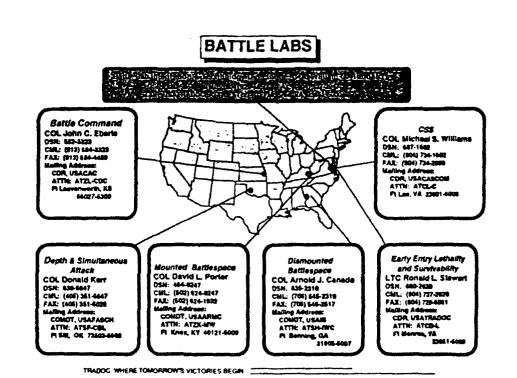








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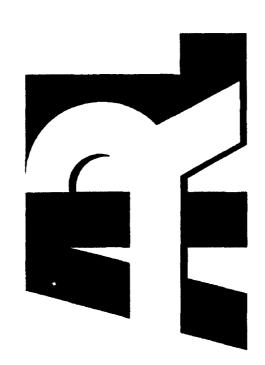
SUMMARY

Battle Labs are a pragmatic approach to problem-solving that allows experimentation — first in simulation and later with soldiers on ranges and manuever areas — with new ideas and emerging technologies.

GEN FRANKS
TRADOC: Seeding Future Victories,
The Army Green Book, Oct 92

THADOC: WHERE TOMORROWS VICTORIES BEGIN

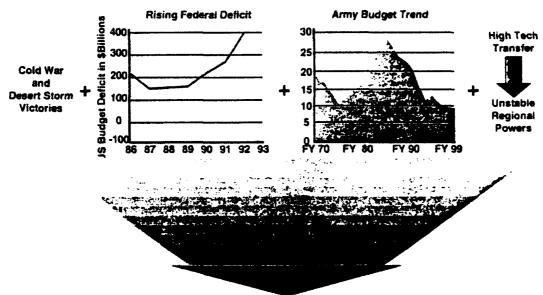
RESEARCH LABORATORY ARMY



Overview of the United States Army Research Laboratory

Mr. Bruce M. Fonoroff Directorate Executive Advanced Concepts anf Plans (ACAP) (301) 394-4106

Our Challenge



- Less Predictable, Rising Threat
- Public Demands Swift, Decisive, Low Casualty Victory
- Less \$

But a smaller Army and defense industry

ISC 93 CI F 2 Our Challenge

Strategic Vision



U.S. Army

A Total Force trained and ready to fight... Serving the nation at home and abroad... A strategic force capable of decisive victory.



Army Materiel Command

The Army's leader in equipping and sustaining the Total Force through superior technology and responsive support assuring worldwide power projection and decisive victory.

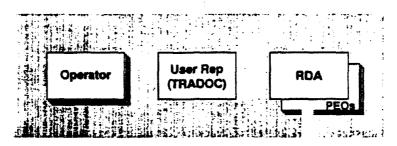


Army Research Laboratory

An efficient, world-class laboratory with the critical mass and flexibility to satisfy the science, technology, and analysis needs of the Army for the 1990s and beyond.

Army S&T Organization

HQ DA



Materiel	Medical	infrastructure/ Environmental	Personnel	Information	Strategic Defense
HQ AMC	HQ MRDC	HQ USACE	DCSPER	ISC	SSDC

J-Army S&T Organization

AMC Organization

HQ AMC

Aviation & Troop Command ATCOM Armaments Commend AMCOM Army Research Laboratory ARL Army Research Office ARO Chemical/ Blological Defense Agency CBDA Communications
& Electronics
Command
CECOM

Aviation RDEC Belvoir RDEC Natick RDEC

Armamenta RDEC Edgewood RDEC Communications & Electronics RDEC

Depot Systems Command DESCOM

Missile Command MICOM Simulation, Training & Instrumentation Command STRICOM

Tank Automative Command TACOM Test & Evaluation Command TECOM

US Army Security Assistance Command USASAC

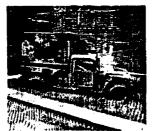
Missile RDEC

Tank Automotive RDEC



Mission

The United States Army Research Laboratory will provide America's soldiers the technology edge through scientific research, technology development, and analysis.





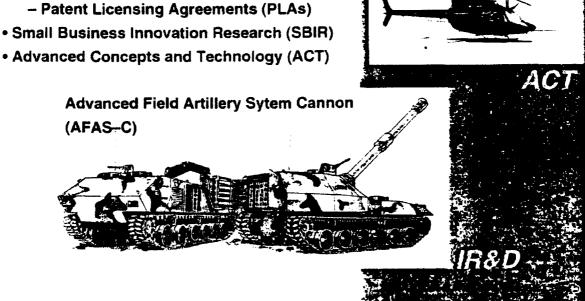


Stabilized Mast Mount

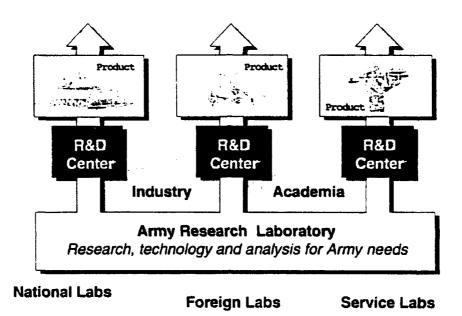


Army-Wide Management Responsibilities Technology Transfer

- Independent Research & Development (IR&D)
- Domestic Technology Transfer
 - Cooperative R&D Agreements (CRDAs)



Corporate Laboratory Role



Revision 1 Chart 7 Jan 93

Army Tech Base Elements

CECOM—CNVEO Optical/IR Research
ARI—MANPRINT for Systems Research
AVSCOM—Aviation Aerostructures Directorate
AVSCOM—Aviation Propulsion Directorate
TACOM—Ground Vehicle Propulsion Research
BRDEC—Tech Base Materials Research
AIRMICS
CRDEC—Chemical & Biological
Vulnerability/Lethality Assessment

LABCOM

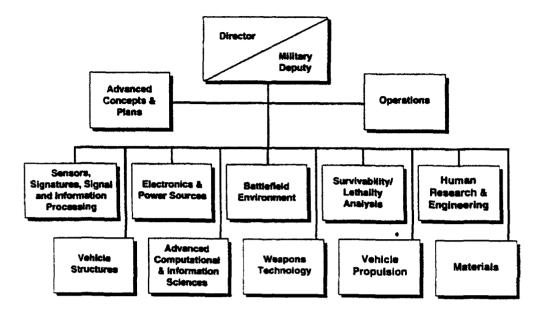
Atmospheric Sciences Laboratory
Bailistic Research Laboratory
Electronics Technology & Devices Laboratory
Harry Diamond Laboratories
Human Engineering Laboratory
Materials Technology Laboratory
Vulnerability Assessment Laboratory
Special Technology Offices

Divestitures
ARO and others

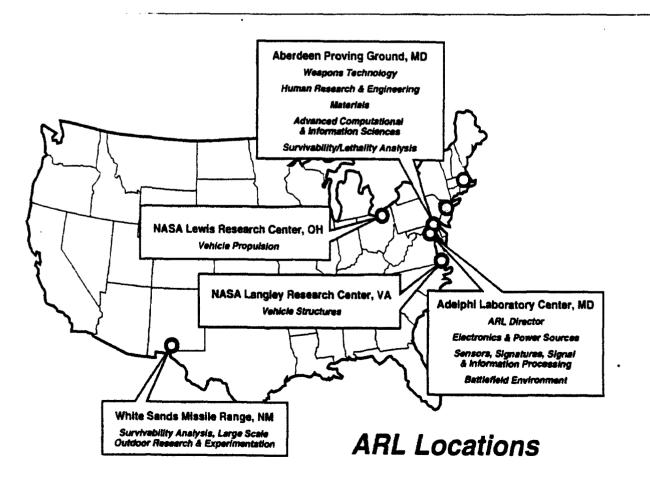
Transition to Army Research Laboratory

Stong in-house capability
Primarily 6.1, 6.2, 6.5
Institutional funding
Limited customer and contract programs
Board of directors oversite
Minimal overhead

ARL Organization



Remoin F Chart 3, Jan. \$3



ARL Personnel Profile

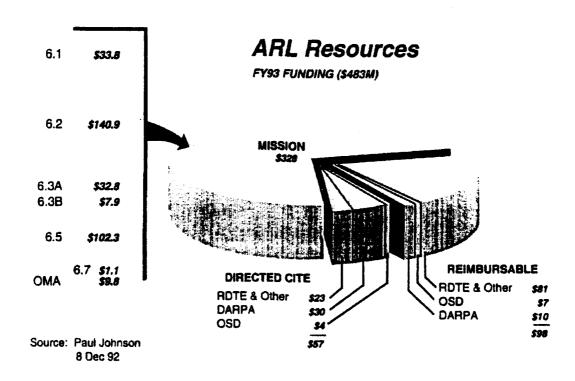
As of Sept. 1992

Scientists & Engineers	1744
Electrical/Electronics Engineers	527
Physicists	228
Mechanical Engineers	179
Materiai Engineers/Metallurgists	112
General/Industrial Engineers	120
Human Factors Engineers	37
Aerospace Engineers	34
Chemical Engineers/Chemists	97
Mathematicians/Statisticians	92
Computer Scientists	50
Meteorologists	34
Physical Scientists	126
Operations Research Analysts	57
Other	51

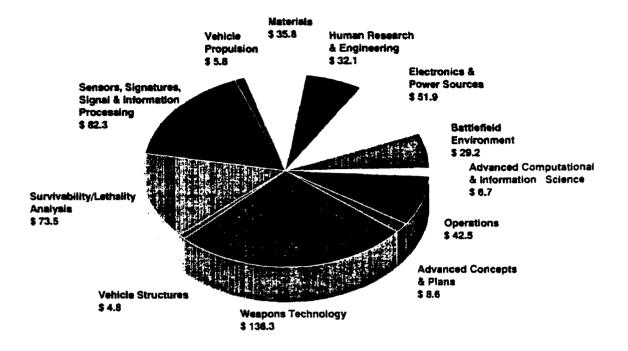
Total Workforce	3653
Bachelors	1207
Masters	528
Doctorates	354



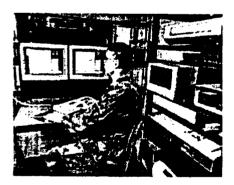
Revision 2 Chan 20, Jan 9



ARL FY 93 Funds By Business Area Total \$509.5M



ISC 93 CI D FONOROFF F-15



Definition

A multidisciplinary team approach for developing and evaluating key technical capabilities and concepts.

Attributes

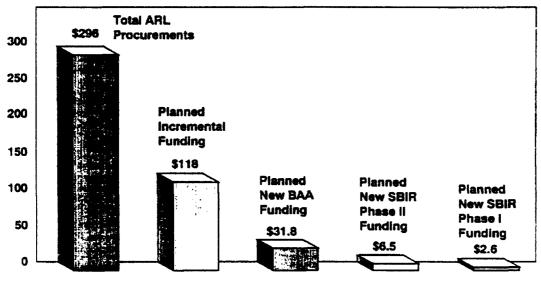
- Major visibility
- Clear objective product/capability
- Finite time frame
- · Single directorate executive has lead

Major ARL Focus Programs

Target Acquisition
Advanced Armored Vehicle Technology
Autonomous Systems Science and Technology
Advanced Artillery Technology
Warrior's Edge



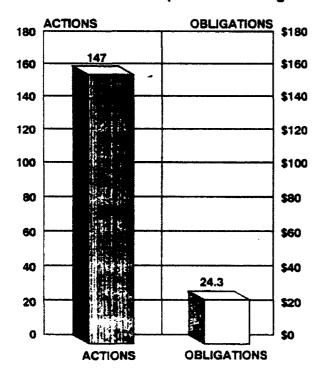
Advanced Procurement Plan SUMMARY



Estimated obligations in millions

1.5V03 Services Street

WT Directorate FY 93 Acquisition Plan (Estimated obligations in millions)

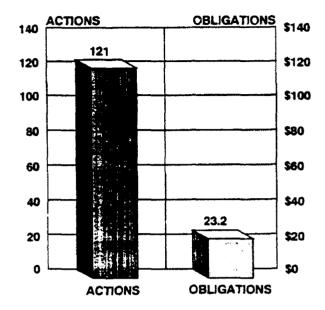


Two new, competitive actions estimated to exceed \$1M each

Plan includes 18 new BAA functions

SLAD Directorate FY 93 Acquisition Plan

(Estimated obligations in millions)

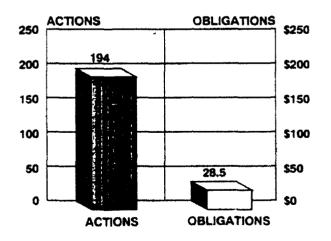


Competitive contracts planned computer simulation

Over half of actions are incremental funding

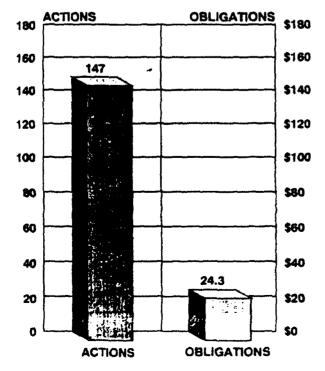
JFY10 F-17

S3I Directorate FY 93 Acquisition Plan (Estimated obligations in millions)



Planning numerous competitive actions under \$100K, extensive use of BAA and SBIR

MAT Directorate FY 93 Acquisition Plan (Estimated obligations in millions)

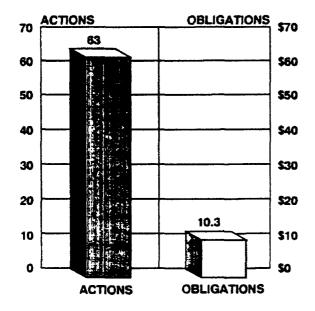


Planning significant SBIR, BAA usage

Most larger obligations are modifications to existing contracts

BE Directorate FY 93 Acquisition Plan

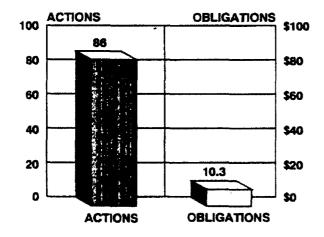
(Estimated obligations in millions)



Most other funded actions are modifications

J-FY85 F-17e

HRE Directorate FY 93 Acquisition Plan (Estimated obligations in millions)

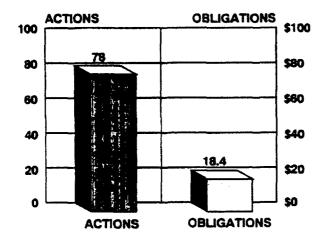


No new contracts estimated to exceed \$500K in plan

Numerous smaller Broad Agency Announcement actions planned

ACIS Directorate FY 93 Acquisition Plan

(Estimated obligations in millions)

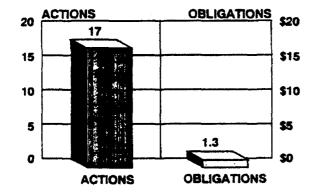


Most obligations shown are modifications to exisiting contracts or currently unfunded actions

J-FY93 F-176

Vehicle Propulsion Directorate FY 93 Acquisition Plan

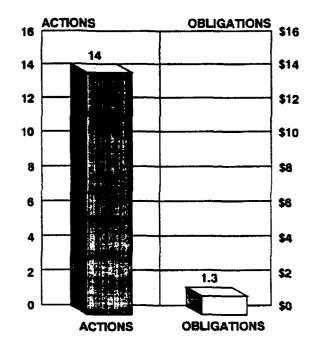
(Estimated obligations in millions)



Most actions are grants to colleges and universities.

Vehicle Structures Directorate FY 93 Acquisition Plan

(Estimated obligations in millions)

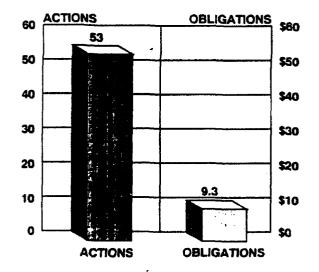


Most actions are planned for colleges and universities.

J-FYEE #-175

ACAP Directorate FY 93 Acquisition Plan

(Estimated obligations in millions)

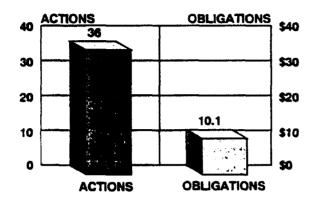


Omnibus Tech Base Contract, 4th Quarter Award

Most others are modifications

OPS Directorate FY 93 Acquisition Plan

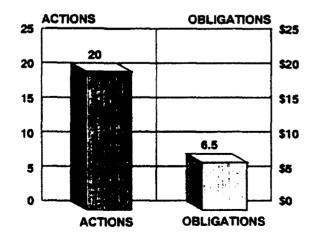
(Estimated obligations in millions)



Most competitive actions are estimated under \$100K, larger actions are modifications.

J-FY10 F-176

Technical Directors Office FY 93 Acquisition Plan (Estimated obligations in millions)



Most actions are modifications to existing contracts



National Technology Policy

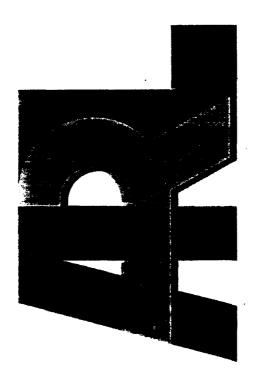
... My technology policy consists of six broad initiatives aimed at helping Americans develop and quickly utilize new technologies:

- 1. Investing in 21st century infrastructure
- 2. Establishing education and training programs for a high skill workforce :
- 3. Investing in technology programs that empower America's small businesses;
- 4. Refocusing Federal R&D programs on critical technologies that enhance industrial performance;
- 5. Leveraging the national R&D investment; and
- 6. Creating a world class business environment for private sector investment and innovation.

President Bill Clinton
Technology: The Engine of Economic Growth
September 21, 1992

ARL CI D-Goldman 3 NTP

LABORATORY EARCH S Ш Œ ARMY



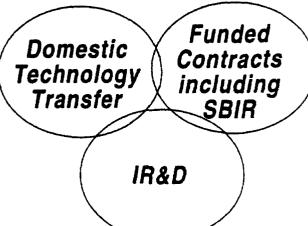
Interfacing with ARL

Dr. Alan J. Goldman Chief Technology Transfer Division, Advanced Concepts and Plans Directorate (301) 394-2410 T).

Purpose

 Mechanism for learning about ARL interests and potential contracts

- Formal programs involving contractor efforts
- Identify points of contact to get additional information



ARL CI O-Goldman 2 Purpose

Agenda



• Technical and Industrial Liaison Programs



Domestic Technology Transfer
 CRDAs and PLAs

1330

Small Business Innovation Research

ACT

• Independent Research and Development

Advanced Concepts and Technology



Technical & Industrial Liaison Office

- Advanced planning information
 - APBI
 - Broad Agency Announcement
 - Descriptive Information
- Match-making
- Unsolicited Proposal guidance
- Potential contractor program
- R&D unfunded studies

S-TILO APRING (GIA)



Current Broad Agency Announcement (BAA)

- Issued October 1992
- Open for 1 year or until superseded
- · Ninety research topics described in detail
- · Technical areas of interest delineated
- Minimum five percent of funds for institutions of higher learning set aside for HBCU/MI



Domestic Technology Transfer

Federal Technology Transfer Laws

The Stevenson Wydler Act (1980) and the Federal Technology
Transfer Act (1986) (15 USC 3701 et seq) mandate active technology
transfer from all Federal Laboratories to the to the Private Sector.

- Provides authority to enter Cooperative R&D Agreements and exclusively license intellectual property (15 USC 3710a)
- Charters the Federal Lab Consortium network to help locate technology
- Emphasizes cooperation/support for Small Businesses
- Provides minimum 15% of royalties to inventors and the majority of the balance to labs

GRAPHICS-ARL - 83 S-Domestic APRIA (27)



Technology Transfer Mechanisms

CRDA: Cooperative Research and Development Agreements

- A pledge by a government laboratory and industry/ academia to conduct joint R&D
- Government provides technical personnel, services, facilities, equipment and other resources, but no funds

- Industry / academia provide funds (if necessary), technical personnel, services, facilities, equipment and other resources
- · Agreement defines sharing of intellectual property

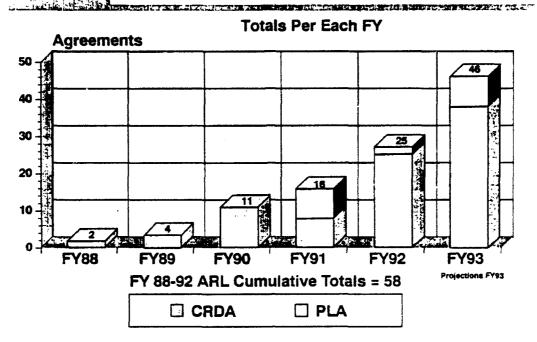
PLA: Patent Licensing Agreements

- Provide financial incentive to inventors and labs
- Assure transition of technology to private sector

GRAPHICS-ARL - 12



ARL Approved CRDAs/PLAs





Selected Examples



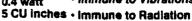
- · Martin Goffman Associates with Army **Electronics and Power Sources Directorate**
- · E&PS Eximer Laser used by Goffman for R&D in Superconductors
- · Applications:
 - High Temp Superconductor for hifrared Detection
 - Low Temp Superconductor for Electronic Devices

Crystal Oscillator Technology **Patent Licensing**



Technology Trends:

- · Lower Power Consumption
- · Lighter and Smaller
- · More Stable (Better Compensated) Frequency Output
- · Immune to Vibrations 0.4 watt









power: 0.5 watt volume: 16 CU inches



CRDA: Potential Research Areas

- Microelectronic Materials, Devices & Circuit Research
- Advanced Aerospace Materials Research & Analysis
- New Materials Stress-Strength-Inspection Technologies (For Both Air & Ground Vehicles)
- High Capacity Batteries & Energy Storage Technologies
- Sensor Fusion Technology

S-Potes. Resourch APE/Q (R11)



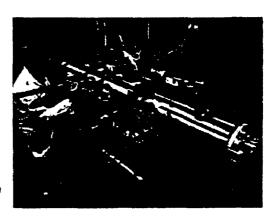
CRDA: Potential Research Areas (Continued)

- Autonomous/Robotic Vehicle Research
- Vehicle Structure & Propulsion Systems Research
- Atmospheric Characterization at all Acoustic & Electromagnetic Wavelengths
- Solderability Techniques
- · Survivability/Lethality Analysis



ARL Unique Facilities Suitable for Potential CRDAs

- · Microwave/Millimeter wave Design Center
- Nanoelectronics Fabrication Facility
- · Cray 2 Facility
- Pulse Power Facility
- Fifty Wind Tunnel Configurations (Sub-, Trans-, Supersonic Flow Rates)
- Small/Medium/Large Caliber Research Facility
- Robotics and Automated Control Laboratory
- Adhesive Bonding Microfactory
- · One of the largest (250') Crash Towers in Existence
- Molecular Beam Epitaxy Facility
- · Triaxis Vibrator Facility
- High Power Microwave/Flash X-Ray/EMP Facilities
- Electro-Optical Vulnerability Assessment Facility (EOVAF)

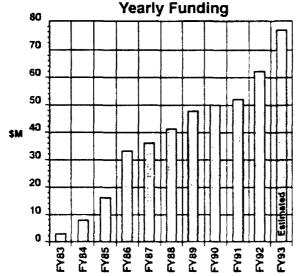


D-Goldman



Army SBIR Program History

Leverage Small Business Capabilities



Phase I
Technical Feasibility (\$100K Max, 6 months)

Phase II R&D Effort (\$750K Max, 2 years)

Phase III
Transition (No SBIR \$)

- Commercialize Products

- Other Government Funding



Composite Materials Braider US Composites Corporation

Fabrication of Fiber Reinforced Polymer Composite Curved Parts



MILITARY USES

Howitzer Parts
Rocket Launch Tubes
Rocket Motor Cases
Lightweight Bridging

COMMERCIAL USES

Golf Shafts
Surgical Tools
Satellite Structures
Aircraft Propellors

ARL CI D-Goldman 25 Composites



FY93 Schedule

•	Issue Solicitation
	(announced in Commerce business bany)
•	Proposals Due 1 July
•	Phase I winners selected 1 September
•	Phase II winners selected Approx. 9 months after Phase I award



Industry Independent Research & Development

- Company Funded, Reimbursed as Overhead
- Still Very Important
- Recent Improvements
 - Full Reimbursement
 - Reduced Reporting
 - More Frequent Guidance
- Concern--Dwindling Procurement \$

GRAPHICS-ARL - 93 J-IRSD Indust, Index, (G17)



An IR&D Success



Patriot

1960s-Basic Technology Established

- · Ferrite Materials
- · Ferrite Base Shifters
- · Space Fed Phased Array

1970-1984-Basic ATM Capability Established

- Missile and Radar Sensitivity and Sub-Clutter Visibility Enhancements
- · Warhead Redesign
- · Corelation Subsystem Clutter Canceler
- · Fuze Signal Processing
- · Software Upgrades
- · Warhead Redesign
- · Microelectronics Insertion

Result

Desert Storm Success

ARL CI D-Goldman IRO Sunnan



Advanced Concepts and Technology

- Encourage Innovation
- Alternative Channel for Good Ideas
- Approximately 2 yrs./\$1M max.
- Funded at \$4-6 Million per year

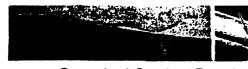
GRAPHICS-ARL - 93 J-ACT Advanced Cen. (Q15)



Computer-Aided Process Design

Steel Heat Treat Process Modeling Replaces Empirical Approach

- Reduce Development Time/Cost
- Improve Quality
- Reduce Reject/Rework



Quenched Cracked Barrel

initial Successful Effort

- · Large, Gun Barrels
- · ACT, ARDEC Benet Lab & ADLittle
- · Problem
 - Quench too quickly-cracks
 - -Quench too slowly-soft steel
- Solution
- -Modelling for process optimization

Helicopter Gear
Dimensional Measurements

Current Effort

- · Helicopter Gears
- ACT, AVSCOM, ,ADLittle, Sikorsky
- Commercial Applications
 - Automotive, Nat'l Center for Manufacturing Science
- Problem
- Heat treat distortion
- -Causes reject/rework
- Solution
- -process design by modelling

Challenge to Industry

- Maintain Awareness of Army Technology Needs
 - Requirements & planning documents
 - Interactions with Labs & Centers
- Focus IR&D on Army Needs / Opportunities
 - Respond to technical evaluations & on-site reviews
- Seek Cooperative Research and Development Agreements (CRDAs) and Patent Licensing Agreements (PLAs)
- Inform Army of Accomplishments
 - Brief Labs & Centers
 - Demonstrate new technologies

GRAPHICS-ARL - 89 J-Chadunge to industry (G21)

"INFORMATION FOR INDUSTRY PROGRAM"

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PR/	

MR. ROBERT M. TOMKO (301) 394-3690

TECHNICAL AND INDUSTRIAL LIAISON OFFICER (TILO)

MR. MELVYN J. SHICHTMAN (301) 394-5075

DOMESTIC TECHNOLOGY TRANSFER COOPERATIVE R&D AGREEMENTS (CRDAs) PATENT LICENSE AGREEMENTS (PLAs)

ARL - MR. MICHAEL CLAFFY (301) 394-4210 ARMY WIDE - MR. CLIFFORD LANHAM (301) 394-4210

SMALL BUSINESS INNOVATION RESEARCH (SBIR)

ARL - MR. M. DEAN HUDSON (301) 394-4808 ARMY WIDE - MR. J. PATRICK FORRY (301) 394-4602

> INDEPENDENT RESEARCH AND DEVELOPMENT (IR&D)

ARL - MR. BRYAN D. JOHNSON (301) 394-2410 ARMY WIDE - DR. ALAN J. GOLDMAN (301) 394-2410

INTERNATIONAL PROGRAMS

DR. DAVID C. HODGE (410) 278-5865 MR. FRED ADLER (301) 394-1400

Date: 12/23/92

ARMY ACCEPTED CRDAs/PLAs (ARL)

TOTAL CRDAs: 48 TOTAL PLAS: 10 TOTAL CPAR CRDAS: 0

CONTROL NO: 9211-A-C234 TYPE: CRDA ACCEPTED: 12/07/92
LAB: ARL ORTA POC: Mike Claffy PHONE NO.: 301-394-4210

COMPANY: Adv Lithography Grp

PURPOSE: For development of ion projection lithography.

CONTROL NO: 9209-A-C222 TYPE: CRDA ACCEPTED: 09/30/92
LAB: HDL ORTA POC: Norma Vaught PHONE NO: 301-394-2952

COMPANY: Delco Electronics

PURPOSE: For R&D of Sequential Electrochemical Reduction Analysis

procedures and equipment in a production environment.

CONTROL NO: 9209-A-C221 TYPE: CRDA ACCEPTED: 09/30/92
LAB: HDL ORTA POC: Norma Vaught PHONE NO: 301-394-2952

COMPANY: Texas Instruments

PURPOSE: For R&D of Sequential Electrochemical Reduction Analysis

procedures and equipment in a production environment.

CONTROL NO: 9209-A-C220 TYPE: CRDA ACCEPTED: 09/30/92
LAB: HDL ORTA POC: Norma Vaught PHONE NO: 301-394-2952

COMPANY: Johns Hopkins Univ

PURPOSE: For R&D on the monitoring and control of printed circuit board

plating thickness.

CONTROL NO: 9209-A-C217 TYPE: CRDA ACCEPTED: 09/29/92

LAB: HDL ORTA POC: Norma Vaught PHONE NO.: 301-394-2952

COMPANY: Univ of MD

PURPOSE: To develop Mossbauer Spectroscopy into a process control tool for

composite solders.

CONTROL NO: 9208-A-C209 TYPE: CRDA ACCEPTED: 12/17/92

LAB: MTL ORTA POC: Dr. Hamed El-Bisi PHONE NO.: 617-923-5396

COMPANY: Assembly Guidance

PURPOSE: For development of improved processing methods for fabricating

parts from composite materials.

CONTROL NO: 9208-A-C207 TYPE: CRDA ACCEPTED: 09/01/92

LAB: HDL ORTA POC: Norma Vaught PHONE NO.: 301-394-2952

COMPANY: Washington Univ

PURPOSE: For development of composite solders.

CONTROL NO: 9207-A-C200 TYPE: CRDA ACCEPTED: 08/10/92
LAB: HDL ORTA POC: Norma Vaught PHONE NO:: 301-394-2952

COMPANY: Univ of MD

PURPOSE: For development of computerized design models for solder behavior

as a function of microstructure.

CONTROL NO: 9207-A-P199 TYPE: PLA ACCEPTED: 08/05/92
LAB: ETDL ORTA POC: Dick Stern PHONE NO:: 908-544-4666

COMPANY: Hewlett-Packard Co

PURPOSE: For a partially exclusive license for U.S. Patent No. 4,410,902,

entitled "Planar Doped Barrier Semiconductor Device".

CONTROL NO: 9207-A-C198 TYPE: CRDA ACCEPTED: 07/23/92
LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666

COMPANY: Techtrol Cyclonetics

PURPOSE: For R&D of ultra-stable low phase noise dielectric resonator

oscillators.

CONTROL NO: 9206-A-C194 TYPE: CRDA ACCEPTED: 07/24/92
LAB: MTL ORTA POC: Dr. Hamed El-Bisi PHONE NO.: 617-923-5396

COMPANY: Composite Dvlpmnt

PURPOSE: For full scale fabrication and optimization of composite cylinder

processing.

COMPANY: Raynet Corp

PURPOSE: For R&D of a surface oxide evaluation system.

CONTROL NO: 9204-A-C176 TYPE: CRDA ACCEPTED: 05/21/92
LAB: HDL ORTA POC: Norma Vaught PHONE NO:: 301-394-2952

COMPANY: Harris Corp

PURPOSE: To study the Sequential Electrochemical Reduction Analysis (SERA) technique for measuring solderability of electronic components.

CONTROL NO: 9204-A-C175 TYPE: CRDA ACCEPTED: 05/21/92
LAB: HDL ORTA POC: Norma Vaught PHONE NO.: 301-394-2952

COMPANY: Motorola, Inc

PURPOSE: To study the Sequential Electrochemical Reduction Analysis (SERA) technique for measuring solderability of electronic components.

COMPANY: McDonnell Douglas

PURPOSE: For development of a design analysis methodology for a composite

helicopter rotor hub.

CONTROL NO: 9203-A-C162 TYPE: CRDA ACCEPTED: 04/17/92

ORTA POC: John Cline LAB: ASTD PHONE NO.: 804-864-3966

COMPANY: McDonnell Douglas

For wind tunnel testing of the British Program - Type Rotor. PURPOSE:

CONTROL NO: 9203-A-C161 TYPE: CRDA ACCEPTED: 04/17/92 PHONE NO.: 804-864-3966 LAB: ASTD ORTA POC: John Cline

COMPANY: McDonnell Douglas

For experimental and analytical impact dynamics research for PURPOSE:

composite rotorcraft structures.

CONTROL NO: 9203-A-C160 TYPE: CRDA ACCEPTED: 05/29/92 LAB: ASTD ORTA POC: John Cline PHONE NO.: 804-864-3966

COMPANY: Bell Helicopter

PURPOSE: For research on composite flexures for rotor hub applications.

CONTROL NO: 9201-A-C143 TYPE: CRDA ACCEPTED: 02/05/92 PHONE NO.: 908-544-4666 ETDL ORTA POC: Dick Stern LAB:

COMPANY: Alpha Industries

PURPOSE: For development of novel semiconductor devices based on planar

doped barrier structures.

CONTROL NO: 9111-A-C136 TYPE: CRDA ACCEPTED: 12/19/91

LAB: HDL ORTA POC: Norma Vaught PHONE NO.: 301-394-2952

COMPANY: MCNC

PURPOSE: For development of a plasma assisted dry soldering procedures and

equipment.

CONTROL NO: 9110-A-C128 TYPE: CRDA ACCEPTED: 11/22/91

LAB: ORTA POC: Dick Stern PHONE NO.: 908-544-4666 ETDL

NJ Inst of Tech COMPANY:

PURPOSE: For development of ultra-high speed and millimeter wave

electronic devices.

CONTROL NO: 9110-A-C126 TYPE: CRDA ACCEPTED: 11/22/91 ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666

Stevens Inst of Tech COMPANY:

PURPOSE: For R&D on optoelectronic device physics and engineering with

applications to microwave and optical integrated circuits.

CONTROL NO: 9110-A-C125 TYPE: CRDA ACCEPTED: 11/22/91

ORTA POC: Dick Stern LAB: ETDL PHONE NO.: 908-544-4666

COMPANY: Rutgers Univ

PURPOSE: For development of smart ceramic materials. CONTROL NO: 9110-A-C124 TYPE: CRDA ACCEPTED: 11/22/91

LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666

COMPANY: Rutgers Univ

PURPOSE: For R&D on laser ablation of ferroelectric and high-temperature

superconducting thin films.

CONTROL NO: 9110-A-C123 TYPE: CRDA ACCEPTED: 11/22/91

LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666

COMPANY: Rutgers Univ

PURPOSE: For development of hermetic coatings for optical waveguides.

CONTROL NO: 9107-A-C113 TYPE: CRDA ACCEPTED: 08/20/91

LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666

COMPANY: Electronics Concepts

PURPOSE: To design and evaluate state-of-the-art high energy density film

capacitors.

CONTROL NO: 9107-A-C107 TYPE: CRDA ACCEPTED: 08/01/91

LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666

COMPANY: Neocera, Inc

PURPOSE: For the development of processes for preparing films of high

transition-temperature (high-Tc) superconducting materials on

single cyrstal.

CONTROL NO: 9107-A-P106 TYPE: PLA ACCEPTED: 12/02/91

LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666

COMPANY: Alpha Industries

PURPOSE: For a partially exclusive license for U.S. Patent No. 4,410,902,

entitled "Planar Doped Barrier Semiconductor Device".

CONTROL NO: 9103-A-C093 TYPE: CRDA ACCEPTED: 04/09/91

LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666

COMPANY: Shipley Co, Inc

PURPOSE: For the development of improved electron beam sensitive resists

for use in the microelectronics industy.

CONTROL NO: 9102-A-C086 TYPE: CRDA ACCEPTED: 03/04/91

LAB: HDL ORTA POC: Norma Vaught PHONE NO.: 301-394-2952

COMPANY: Intgrt Tech for Med

PURPOSE: For fabrication and evaluation of microfluidic components.

CONTROL NO: 9101-A-C083 TYPE: CRDA ACCEPTED: 02/08/91

LAB: HDL ORTA POC: Norma Vaught PHONE NO.: 301-394-2952

COMPANY: VPI & State Univ

PURPOSE: To jointly develop, test and evaluate the use of fluidic

technologies coupled with fiber optic systems.

CONTROL NO: 9101-A-P082 TYPE: PLA ACCEPTED: 01/23/91

LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666

COMPANY: Ball Corp

PURPOSE: For a partially exclusive license for a Dual Mode Quartz

Thermometric Sensing Device, U.S. Patent No. 4,872,765.

CONTROL NO: 9101-A-P081 TYPE: PLA ACCEPTED: 01/23/91

LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666

COMPANY: Frequency Electronic

PURPOSE: For a partially exclusive license for a Dual Mode Quartz

Thermometric Sensing Device, U.S. Patent No. 4,872,765.

CONTROL NO: 9101-A-P080 TYPE: PLA ACCEPTED: 01/23/91

LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666

COMPANY: Motorola, Inc

PURPOSE: For a partially exclusive license for a Dual Mode Quartz

Thermometric Sensing Device, U.S. Patent No. 4,872,765.

CONTROL NO: 9101-A-P079 TYPE: PLA ACCEPTED: 01/23/91

LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666

COMPANY: Piezo Crystal Co

PURPOSE: For a partially exclusive license for a Dual Mode Quartz

Thermometric Sensing Device, U.S. Patent No. 4,872,765.

CONTROL NO: 9101-A-P078 TYPE: PLA ACCEPTED: 01/23/91

LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666

COMPANY: Piezo Technology

PURPOSE: For a partially exclusive license for a Dual Mode Quartz

Thermometric Sensing Device, U.S. Patent No. 4,872,765.

CONTROL NO: 9101-A-P077 TYPE: PLA ACCEPTED: 01/23/91

LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666

COMPANY: Q-Tech Corp

PURPOSE: For a partially exclusive license for a Dual Mode Quartz

Thermometric Sensing Device, U.S. Patent No. 4,872,765.

CONTROL NO: 9101-A-P076 TYPE: PLA ACCEPTED: 01/23/91

LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666

COMPANY: Vectron Labs

PURPOSE: For a partially exclusive license for a Dual Mode Quartz

Thermometric Sensing Device, U.S. Patent No. 4,872,765.

CONTROL NO: 9011-A-C073 TYPE: CRDA ACCEPTED: 03/04/91

LAB: MTL ORTA POC: Dr. Hamed El-Bisi PHONE NO.: 617-923-5396

COMPANY: PPG Industries, Inc

PURPOSE: For characterization and possible further development of

oxymitride glass fibers.

CONTROL NO: 9010-A-C071 TYPE: CRDA ACCEPTED: 11/06/90

LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666

COMPANY: Norden Systems, Inc

PURPOSE: For development of a portable flat panel display workstation.

CONTROL NO: 9009-A-P066 TYPE: PLA ACCEPTED: 11/29/90

LAB: HDL ORTA POC: Norma Vaught PHONE NO.: 301-394-2952

COMPANY: Defense Res Tech

PURPOSE: For an exclusive license for fluidic mud pulsers, U.S. Patent

Nos.: 4,276,943; 4,291,395; 4,323,991; 4,391,299; 4,557,295.

CONTROL NO: 9008-A-C062 TYPE: CRDA ACCEPTED: 09/06/90

LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666

COMPANY: Rutgers Univ

PURPOSE: To advance the development of ultra high speed and millimeter

wave electronic devices.

CONTROL NO: 9006-A-C056 TYPE: CRDA ACCEPTED: 07/20/90

LAB: HDL ORTA POC: Norma Vaught PHONE NO.: 301-394-2952

COMPANY: M/A-COM

PURPOSE: To perform cooperative research, test and evaluate the operation

and damage characteristics of solid-state PIN diodes.

CONTROL NO: 9006-A-C055 TYPE: CRDA ACCEPTED: 07/20/90

LAB: HDL ORTA POC: Norma Vaught PHONE NO.: 301-394-2952

COMPANY: McDonnell Douglas

PURPOSE: To design, develop, evaluate and test Artificial

Intelligence/expert computer software systems and their

supporting technologies such as terrain reasoning.

CONTROL NO: 9006-A-C053 TYPE: CRDA ACCEPTED: 07/12/90

LAB: HDL ORTA POC: Norma Vaught PHONE NO.: 301-394-2952

COMPANY: Rockwell Intntl Corp

PURPOSE: To test and evaluate automated 3-D X-Ray equipment in a

production environment.

CONTROL NO: 9005-A-C052 TYPE: CRDA ACCEPTED: 07/02/90

LAB: HDL ORTA POC: Norma Vaught PHONE NO.: 301-394-2952

COMPANY: Grumman Aerospace

PURPOSE: To test and evaluate an analog electronic device to clip or limit

the amplitude of a transmission signal.

CONTROL NO: 9002-A-C038 TYPE: CRDA ACCEPTED: 03/06/90
LAB: ETDL ORTA POC: Dick Stern PHONE NO:: 908-544-4666

LAB: ETDL ORTA POC: Di COMPANY: Martin Marietta Corp

PURPOSE: For development of a permanent magnet system for a microwave

tube.

CONTROL NO: 8912-A-C036 TYPE: CRDA ACCEPTED: 01/18/90

LAB: HDL ORTA POC: Norma Vaught PHONE NO.: 301-394-2952

COMPANY: J&S Software Dvlpmt

PURPOSE: For development of systems operation software which would be

applicable for large IMB compatible environments.

CONTROL NO: 8912-A-C035 TYPE: CRDA ACCEPTED: 01/09/90

LAB: MTL ORTA POC: Dr. Hamed El-Bisi PHONE NO.: 617-923-5396

COMPANY: WAMDP, Inc

PURPOSE: For development of advanced automated manufacturing systems.

CONTROL NO: 8911-A-C033 TYPE: CRDA ACCEPTED: 12/29/89

LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666

COMPANIES: Emcore Corp; American Cyanamid; Polytechnic Univ

PURPOSE: To investigate how to improve the quality of OMVPE-grown

structures and to attempt to find substitutes for highly toxic

gases.

CONTROL NO: 8909-A-C029 TYPE: CRDA ACCEPTED: 10/03/89

LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666

COMPANY: Martin Goffman Ascts

PURPOSE: For development of optical, infrared, and microwave detectors

using superconducting technology.

CONTROL NO: 8909-A-C028 TYPE: CRDA ACCEPTED: 10/06/89

LAB: HDL ORTA POC: Norma Vaught PHONE NO.: 301-394-2952

COMPANY: LTS Corp

PURPOSE: For development of a laser microscopy system for the commercial

market.

CONTROL NO: 8908-A-C024 TYPE: CRDA ACCEPTED: 09/22/89
LAB: MTL ORTA POC: Dr. Hamed El-Bisi PHONE NO.: 617-923-5396

COMPANY: Owens-Corning

PURPOSE: For conducting tensile testing and chemical analysis of specimens

of novel oxynitride glass fibers.

CONTROL NO: 8908-A-C023 TYPE: CRDA ACCEPTED: 09/22/29 LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666

COMPANY: EMC Technology, Inc

PURPOSE: For designing, developing and evaluating high performance

digitally programmable attenuators, components, circuits and

subassemblies.

CONTROL NO: 8935-A-C018 TYPE: CRDA ACCEPTED: 06/21/89
LAB: ETDL ORTA POC: Dick Stern PHONE NO:: 908-544-4666

COMPANY: Res Triangle Inst.

PURPOSE: For E-Beam Probing of Differential Cascode Voltage Switch (DCVS).

COMPANY: Electromagnetic Sci

PURPOSE: For millimeter wave high power ferrite control devices.

COMPANY: Trontech

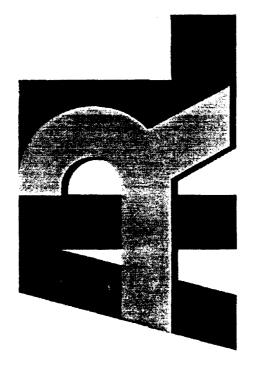
PURPOSE: For development of high frequency oscillators and amplifiers.

COMPANY: Dow Chemical

PURPOSE: For development of advanced ceramic engine components and

advanced lightweight armor applications.

LABORATORY EARCH S Ш Œ ARMY



Weapons Technology

Dr. John Frasier Directorate Executive Weapons Technology (WTD) (410) 278-6244



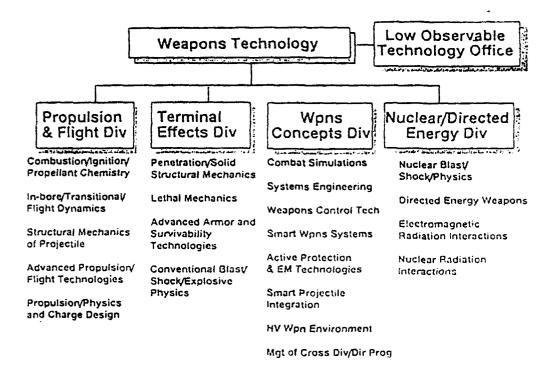
DIRECTORATE MISSION

Lead the Army's research and technology program to enhance the lethality and survivability of weapons systems

- by conceiving, developing, and transitioning concepts and technologies in conventional, nuclear, and directed energy effects;
- by solving technical problems associated with developmental and fielded weapon systems;
- by maintaining a weapons-oriented basic research program.

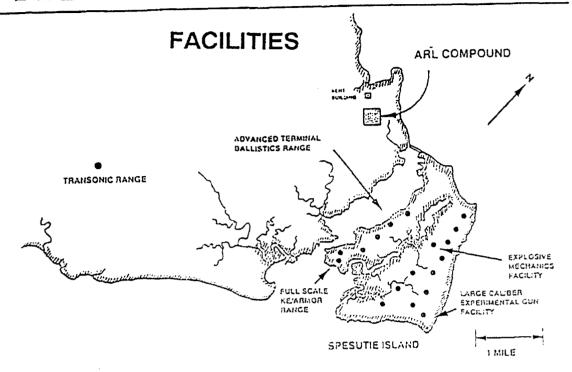
Meet the soldiers' technology needs for advanced weaponry

The mission is detailed on this chart. Research is pursued in energetic materials dynamics, propulsion/flight physics, projectile/warhead mechanics, terminal effects phenomena, armor/survivability technologies, advanced munition/weapons concepts, nuclear weapons effects/survivability technologies, directed energy effects, low observable technologies and system effectiveness analysis. The primary customers are those who develop weapons systems which enhance the lethal defense posture. WTD supports the Army RDE Centers, other Commands, other Services, and various PEOs and PMs such as PEO Armored Systems Modernization, PEO for Intelligence and Electronic Warfare, PM for Tank Main Armament Systems and PM for Advanced Field Artillery Systems. Major efforts include support for the liquid propellant and unicharge candidate selection and studies on electrothermal chemical propulsion.

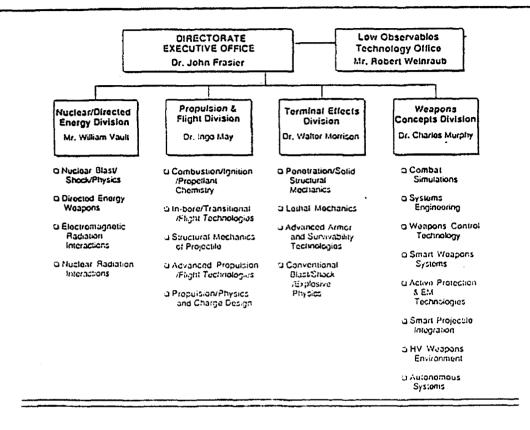


DIRECTORATE SNAPSHOT

This is as good as any way to quickly get an understanding of the current organization. While keeping the "traditional" ballistic mission of BRL, WTD has surrendered the high performance computing mission and the ballistic survivability/lethality assessment mission. Low observable technology and the nuclear and directed energy missions were added. We have already noticed some interesting collaboration opportunities as a result of these new communication channels in ARL.

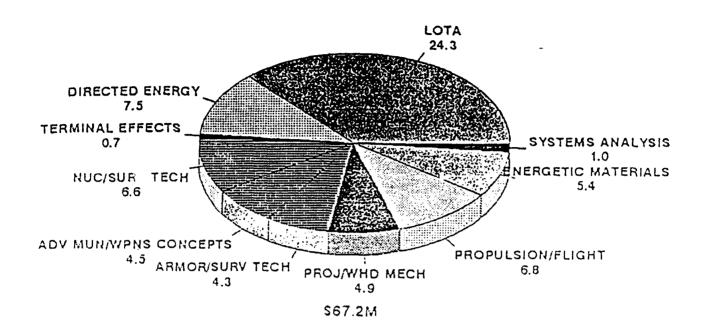


WTD has a number of experimental test facilities, most of which are located on Spesutie Island in the flats of the Susquehanna River. They include energetics/explosive test facilities, high pressure facilities, shock tubes, a transonic ballistic facility, a closed facility for containing depleted uranium shote. The Adelphi Site of ARL houses the Aurora gamma ray facility and EMP simulators are located at the Woodbridge Site.



FLOW OF THE BRIEFING

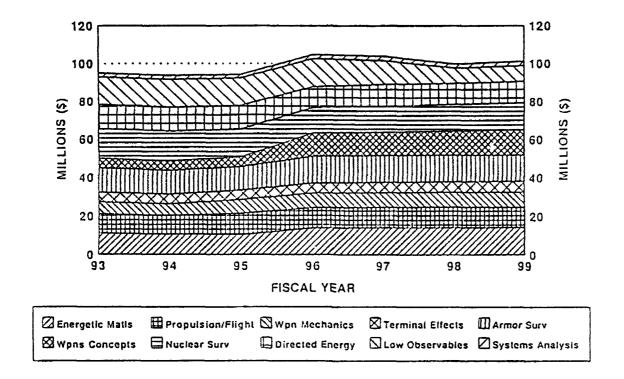
Today I will start with two general funding charts. Then I will generally move left to right through the technical focus of each division. At the end I'll finish with a few real and immediate business opportunities that are important to us and may be of interest to you.



FUNDING PIE

By business area, you can see that the low observable technology area has significant current funding levels. The rest is relatively equally divided among the traditional ballistic and nuclear/directed energy lines.

WEAPONS TECHNOLOGY DIRECTORATE TOTAL REVENUE BY COMPETENCY SUB-ELEMENT



FUNDING PROJECTIONS

If you care to have faith in future funding projections or in stable world political and economic events this may be of value. Only one comment here, the weapons concepts work which I will talk to later shows a trend upward from FY95-FY96.



NUCLEAR AND DIRECTED ENERGY DIVISION

Technical Focus

- RF/DIRECTED ENERGY WEAPON RESEARCH
 - HPM SOURCES, ANTENNAS, MODE CONVERTERS
 - COMPACT, RUGGED PULSE POWER SOURCES
 - HPM TESTING OF MILITARY SYSTEMS
 - HPM HARDENING TECHNOLOGY AND DEVICES
 - HPM WEAPONS EFFECTIVENESS MODELING
- NUCLEAR SURVIVABILITY RESEARCH
 - SURVIVABILITY ENHANCEMENT TECHNOLOGY
 - ELECTROMAGNETIC SHIELDING AND BLAST/THERMAL RESPONSE OF NONMETALLIC MATERIALS
 - IMPROVED PREDICTION AND ANALYSIS CODES
 - SURVIVABLE ELECTRONICS AND MATERIALS

WEAPONS TECHNOLOGY DIRECTORATE NDED

The focus of NDED is listed here. Both the feasibility and effectiveness of DE weapons are of interest as well as measures to protect U.S. systems. This includes HPM sources, antemmas and pulsed power, testing, modeling and hardening. Nuclear hardening of future systems includes state-of-the-art electronics and nonmetallic structures which pose a special challenge for prediction and analysis codes necessary to evaluate future weapons environments and design trade-offs.



PROPULSION & FLIGHT DIVISION

Technical Focus

- Interior, exterior and transitional ballistics
- · Mechanics and dynamics of projectiles
- Advanced projectile, propulsion and flight concepts for chemically and electrically-powered guns
- State-of-the art models and design methodologies
- Transition of Projectile, Propulsion, and Flight Technologies to RDEC's, PEO's/PMs and Industry

WEAPONS TECHNOLOGY DIRECTORATE PFD

Emphasis here is in the state-of-the-art models and design methodologies. Novel concepts being explored are low vulnerability propellants, electrothermal gun propulsion, drag-reducing propulsion for KE projectiles, bulk-loaded and regenerative liquid propellant guns, laser initiation for large caliber guns, ram accelerators, and composites for lightweight ballistics.



TERMINAL EFFECTS DIVISION

Technical Focus

Lethality

KE Penetrators

Ballistic Shock Damage

Survivability

Armors (Passive, Reactive, Special)

Electromagnetic Armor

Insensitive Munitions

Ammunition Compartmentalization

Computational Terminal Ballistics

Material Modeling

Simulation of DE/EFP/KE Target Interactions

Simulation of Advanced Armor Configurations

Simulation of Vehicle Response to Ballistic Events

WEAPONS TECHNOLOGY DIRECTORATE TED

Here we look at both sides of the lethalitysurvivability issue with a combination of experiments, models, theory, and simulations.



WEAPONS CONCEPTS DIVISION

Technical Focus

- Active Protection Systems
- Hypervelocity Ballistics
- Hybrid In-bore Ramjet Technology
- Low Vulnerability Ammunition
- Robotics and Autonomous Systems
- Combat / Technology Simulations
- Generic Systems Effectiveness

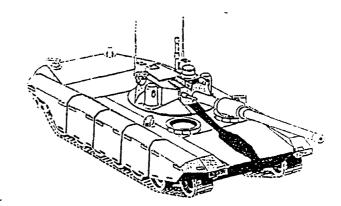
WEAPONS TECHNOLOGY DIRECTORATE WCD

Emphasis here is in the novel leap-ahead technologies and systems. If there is an area of growth or increased emphasis it is in weapons concepts and systems analysis. It is in this Directorate that you will find three of the ARL focus programs that were discussed by Mr. Vitali.



ARL Focus Programs

Advanced Armored Vehicle Technology



KEY PLAYERS

ARL	
(WTD)	Weapons Technology Directorate (lead)
(HRED)	Human Research & Engineering Directorate
(MATD)	Materials Directorate
(VSD)	Vehicle Structures Directorate
(SLAD)	Survivability/Lethality Analysis Directorate
(EPSD)	Electronics & Power Sources Directorate
(Olís)	Sensors, Signatures, Signal & Information Processing Directorate
(VPD)	Vehicle Propulsion Ofrectorate
Other A	Army
(TACOM)	Tank-Automotive Command

(ARDEC) Armament RDE Center

Key to the focus programs is the across ARL scope of the research. By bringing the diverse expertise of ARL together, novel future systems can be evaluated. We certainly cannot work in a vacuum in these areas and as you can see we want to get all the right technologists involved from other government labs and the private sector.

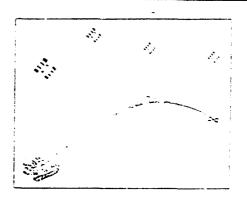


ARL Focus Programs

Advanced Artillery Technology

KEY PLAYERS

ARL	
(VVTO)	Weapons Technology Directorate (Lead)
(HRED)	Human Research & Engineering Directorate
(3ED)	Battlefield Environment Directorate
(S ² ID)	Sensors, Signatures, Signal & Information Processing Directorate
(MATO)	Materials Directorate
(SLAD)	Survivability/Lethality Analysis Directorate



(Ft. Sill)	Artillery Center & School
(ARDEC)	Armament SDE Center
(MICOM)	Missile Command
(AMSAA)	Army Materiel Systems Analysis Activity
	Office of Secretary of the Army (ADA)



ARL Focus Programs

Autonomous Systems Science and Technology

KEY PLAYERS

ARL	
(WTD)	Weapons Technology Directorate (lead)
(HRED)	Human Research & Engineering Oirectorate
(SID)	Sensors, Signatures, Signal & Information

Processing Directorate (EPSD) Electronics & Power Sources Directorate

Other Army

(CRDEC) Chemical RDE Center

(TACOM) Tank-Automotive Command (CSTA) Combat Systems Test Activity

Toocle Army Depot

(CAC) Combined Arms Center



Other Government

(JPO-UGV) Joint Project Office for Unmanned

Ground Vehicles

(ORNL) Oak Ridge National Laboratory (NIST)

Hational Institute for Standards & Technology

Jet Propulsion Laboratory (JPL)

Industry

FMC Corporation

Odetics, Inc. Alliant Tech, Inc.

Oynamic System Technology, Inc.



BROAD AGENCY ANNOUNCEMENT

Low Observable Technology
High Power Microwave Technology
Non-nuclear EMP Technology
Nuclear Survivability

The Weapons Technology Directorate topics in the current BAA are limited to the Low Observable Technology Office and the Nuclear/Directed Energy Division areas of interest. 10 research areas are related to low observables, 5 are in the radio frequency directed energy area and 3 involve nuclear survivability research. These topics are open through September 30, 1993. Instructions on how to submit proposals are in the solicitation.



SMALL BUSINESS INNOVATION RESEARCH (SBIR)

- Magnetic Launch Coils for Flat Plates
- Algorithmic Aspects of Computational Terminal Ballistics
 - Material Modeling in Computational Terminal Ballistics
- Geometry & Vulnerability Descriptions for Helicopters

The next SBIR solicitation is concerned with the above subjects. We are striving to make progress in terminal ballistics as we did in the free flight computational fluid dynamics. Active protection systems need to consider electromagnetic launch rather than explosive launch and the associated problems. A quicklook to get an idea of the effectiveness of a weapons system against a helicopter before an in-depth assessment is made would be a useful evaluation tool.



COOPERATIVE R&D OPPORTUNITIES

Laser Technology Applications
Computational Fluid Dynamics
Explosive Synthesis of Ceramics
New Technologies, Weapons & Concepts
Composites

Technology applications in WTD do not often directly relate to commercial products of great economic importance, however we do contribute to the state-of-the-art in several areas. Here is a list of a few technologies we feel are suitable for joint pursuit. A variety of teaming approaches are possible. If we can leverage our R&D money with outside talent and resources, get a better defense product, and help the economy of the country, or maintain the technical infrastructure, WTD is definitely interested in talking with you.



INTERFACE w/ ARL @ APG

Advanced Concepts and Plans (ACAP) Technology Transfer Division

Rich Dimmick Mike Rausa (410) 278-6955 (fax) 278-7962

- Industry Programs
- Commercialization of Technology

If you need to know more about opportunities with ARL, Directorates located at Aberdeen Proving Ground or any of the technologies mentioned in the briefing, the Technology Transfer Division is the best place to start.

LABORATORY SEARCH Ш Œ ARMY



Mr. Richard D. Slife Assistant Director for Programs, Sensors, Signatures, Signal and Information Processing (S³I) (301) 394-2002



SENSORS, SIGNATURES, SIGNAL AND INFORMATION PROCESSING

PRESENTED AT:

U.S. ARMY RESEARCH LABORATORY ADVANCE PLANNING BRIEFING FOR INDUSTRY (APBI) 28 JANUARY 1993

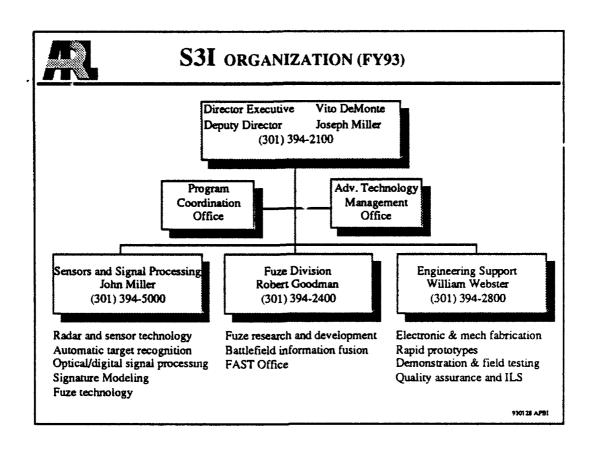
MR. RICHARD SLIFE ASSISTANT DIRECTOR FOR PROGRAMS SENSORS, SIGNATURES, SIGNAL AND INFORMATION PROCESSING

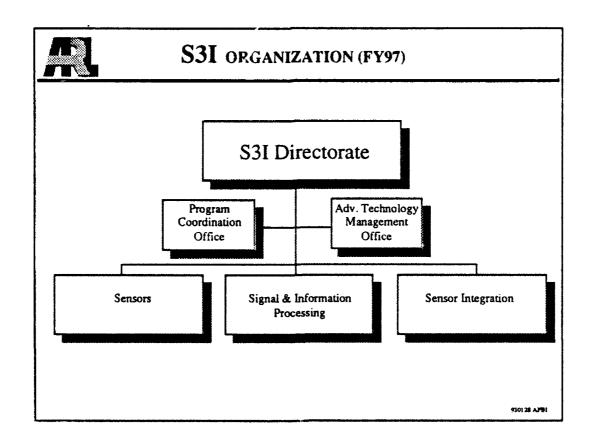


S3I MISSION

Conduct research to create sensor and signal/data processing technologies and concepts capable of adaptive operation and automated fusion as well as supporting real-time information distribution to enable the Army to acquire, locate, identify and engage the enemy in real time and under all battlefield environmental conditions.

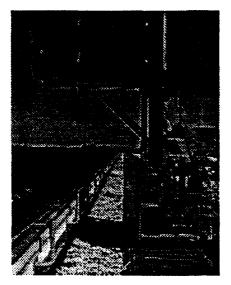
970125 APRI







SENSOR TECHNOLOGY



Ultra Wideband Foliage Penetration SAR

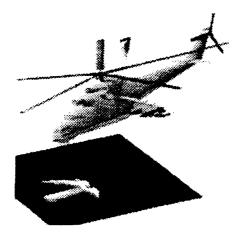
Sensor technology developed by S3I enables the detection and engagement of enemy forces. Specific applications developed here include:

- MTI radar for unmanned aerial vehicles
- Synthetic Aperture Radar
- Millimeter Wave Radar
- Guidance Integrated Fuzing

970128 APRI



SIGNATURES



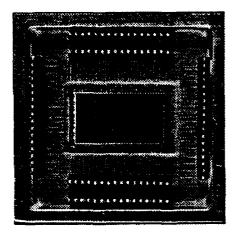
Target Signature Modeling

To support the development of advanced sensors and algorithms for future weapon systems, we are researching techniques to improve signature prediction for FLIR, visible, MMW, LADAR, radar, and SAR sensors. As the complexity and degree of these advanced sensor systems increase, the importance of signature modeling in controlling the costs of testing these system concepts becomes significant.

93 Q1 28 A/FB1



SIGNAL PROCESSING



CCD Array

Optical processing modules provide high throughput capability in compact packages. When configured in hybrid optical/digital systems, real-time operation can be achieved for radar, communications, and target recognition applications.

930125 AFSI



INFORMATION PROCESSING & SENSOR FUSION



Combat Information Processor

The battlefield commander's staff needs to gather, integrate, and process combat information. We have designed the Combat Information Processor and the AI Module to integrate near-real-time information from many sensors and sources to assist the battlefield commander in the decision making process.

930128 AFBI



FUZE DEVELOPMENT/PRODUCTION

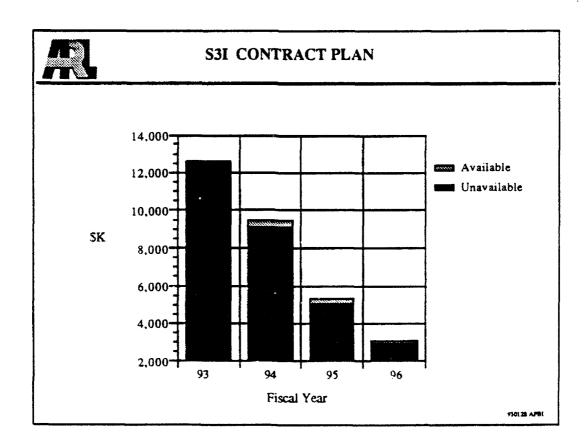


PATRIOT

S3I performs engineering development and production support for fuzes on a selective basis. Fuzes developed here include:

PATRIOT (M818E2) Chaparral (M817E1) MOFA (XM773) M732A2 M734E1

9301 28 AFSI





RADAR

Real Aperture Stationary Target Radar - Detect, discriminate, and classify stationary targets using a low depression angle real aperture radar.

Moving Target Radar Technology - All-weather long-range wide area detection, location, and classification of moving targets.

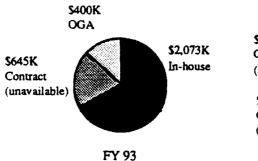
Ultra Wideband Foliage Penetration Synthetic Aperture Radar - All-weather, wide area detection, location and classification of stationary tactical ground targets concealed by foliage, including surface and buried mines.

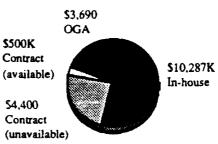
Jeffrey Sichina, (301) 394-2530 U.S. Army Research Laboratory ATTN: AMSRL-SS-SG 2800 Powder Mill Road Adelphi, MD 20783-1145

930128 APBI



RADAR FUNDING





FY 94-96

9301 28 APBJ



PHOTONIC PROCESSING

Develop and demonstrate optical techniques, devices, and modules for real-time, high throughput signal processing applications, with module integration into processing systems.

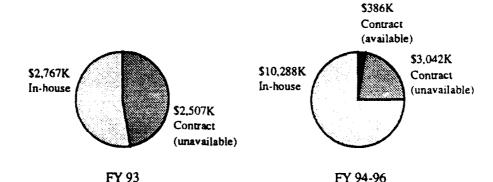
Research efforts focused in these areas: diffractive optics, optical scale-space processing, higher order statistics, photorefractive processors, integrated photonic processing systems, and coherence and photonic processing.

Dr. John Pellegrino (301) 394-2520 U.S. Army Research Laboratory ATTN: AMSRL-SS-SF 2800 Powder Mill Road Adelphi, MD 20783-1145

930128 APBI



PHOTONIC PROCESSING FUNDING



9501 28 AFBT



S3I TECHNOLOGY ASSESSMENT

Develop and maintain cognizance of signature data, sensor, and signal processing technology efforts throughout the DoD community. Identify and recommend appropriate balance of these efforts and emphasize the most promising technical approaches to new sensor and signal processing technology for next generation automated sensor systems.

> Dr. Norman Berg, (301) 394-2500 U.S. Army Research Laboratory ATTN: AMSRL-SS-M 2800 Powder Mill Road Adelphi, MD 20783-1145



S3I TECHNOLOGY ASSESSMENT FUNDING

Battlefield Acoustic Technology

\$910K In-house



\$1,136K Contract (unavailable) \$2,395K In-house

Contract (available)

\$250K

\$395K Contract (unavailable)

FY 93

FY 94-96

930128 AFRI



TARGET ACQUISITION & BATTLE MANAGEMENT

ARL Focus Program -- S3I has lead

Technology Areas:

Ultra Wideband Synthetic Aperture Radar Technology

EO/Radar Sensor Technology for Multi-sensor Stationary Target Indication

Radar Sensor Technology for Multi-sensor Moving Target Indication

Ground-based Passive Multi-sensor ID & Classification Technology

Staff Tactical Operations Center Work Station

930128 AFSI



S3I SMALL BUSINESS INNOVATION RESEARCH FY 93 Funding and Topics

\$1.980K

Signal Processing \$654K

\$399K



Radar/Sensors \$727K

Electronics Assy/Inspect \$200K

Impulse radiating antenna
Digital waveform generator
Angular rate sensor

Electronically scanned antenna Knowledge-based target classification

Oxygen pump for low noise fluidics RF diode laser modulator

Multi-layer microstrip antenna Acceleration sensing module GPS frequency translator IC Miniature RF filters & low power oscillators

Low power MMIC

Surface-relief diffractive lenses

PC-based diffractive optical element mask generator Laser pattern generator for diffractive optical elements

Noise filters

Microscale fluid devices

High speed solder paste printer

Panoramic image translation of microelectronic assy

Automated composite inspection system

9301 28 AFBI



FY93 BROAD AGENCY ANNOUNCEMENT

Materials
Devices and Modules
Processing Algorithms
Novel Optical Processing Systems

Optical System Performance High-Density DSP Circuitry Analog/Digital Conversion Frequency Selective Filter RF Signal Processing

Advanced Acoustic Sensors Automatic Target Recognition Artificial Intelligence Multistatic Radar Technology

Safety and Arming Systems
Sensors
Signal Processing
Global Positioning System

Environmental & Interior Ballistic Simulation

John Pellegrino, (301) 394-2520 John Pellegrino, (301) 394-2520 John Pellegrino, (301) 394-2520 John Pellegrino, (301) 394-2520

Mike Patterson, (301) 394-2520 Mike Patterson, (301) 394-2520 Mike Patterson, (301) 394-2520 Mike Patterson, (301) 394-2520 Mike Patterson, (301) 394-2520

Bruce Weber, (301) 394-2500 Mark Hamilton, (703) 704-1677 Philip Emmerman, (301) 394-3000 Mike Kolodny, (301) 394-3110

Greg Sztankay, Bill Konick (301) 394-3130, (301) 394-2525

930128 AFBI



POINTS OF CONTACT

Broad Agency Announcement Unsolicited Proposals SBIR SBIR (S3I)

Small & Disadvantaged Business Competition Advocate Technology Transfer Technology Transfer (S3I) Public Affairs Beth Bowen, (301) 394-2964 Mel Shichtman, (301) 394-5075 Dean Hudson, (301) 394-4808 Shirley Corbett, (301) 394-4602

Tom Rodgers, (301) 394-1076 Mary Ellen Caldwell, (301) 394-3882 Mike Claffy, (301) 394-4210 Norma Vaught, (301) 394-2952 Marian Singleton, (301) 394-3590

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Combat Identification Briefing APBI to

28 January 1993 Mr. Dick Slife ARL S3ID

MISSION

From GEN Sullivan:

Pull Together and Establish a TRADOC/AMC Task Force (TRADOC LEAD) to lay out a Comprehensive Army Program, addressing both short and long term requirements and solutions, and detailing the interfaces necessary with other Services and Allies. For near term, concentrate on tactical level for surface-to-surface and air-to-surface. For far term, expand on operational level and include air-to-air and surface-to-air.

"The Army cannot accept casualties that can be prevented by our own actions to improve identification in combat."

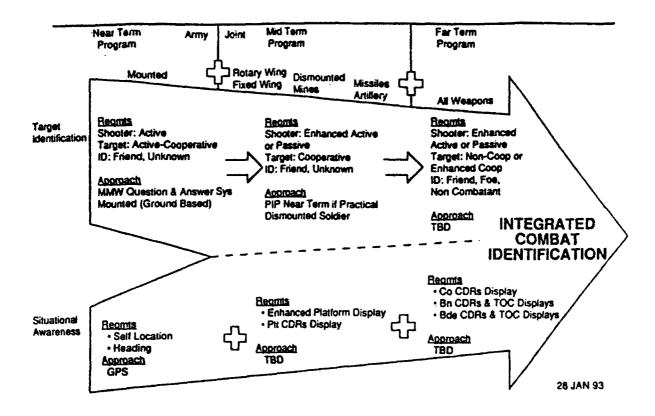
"I want to make sure that we are properly organized to focus our efforts in this area."

28 JAN 93

COMBAT IDENTIFICATION CONCEPT

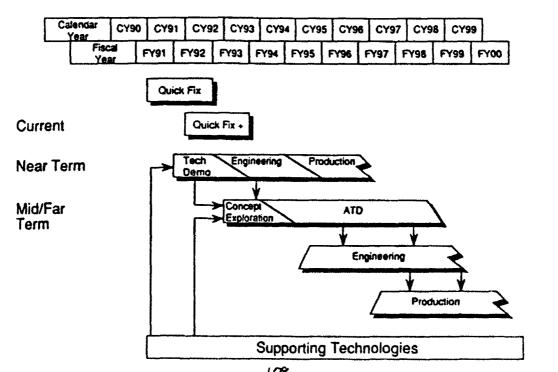
- Improved Situational Awareness
 - Mission, Enemy, Terrain, Troops Time
 - Know Where I Am
 - Know Other Friendly Locations
 - Know Neutral and Enemy Locations
- Improved Target Identification
 - Thru-Sight Target ID Indication to Maximum Weapons Range
 - Make Less Sensitive to the Environment
 - Work for Passive, Non-Cooperative Identification

Architecture for CID System

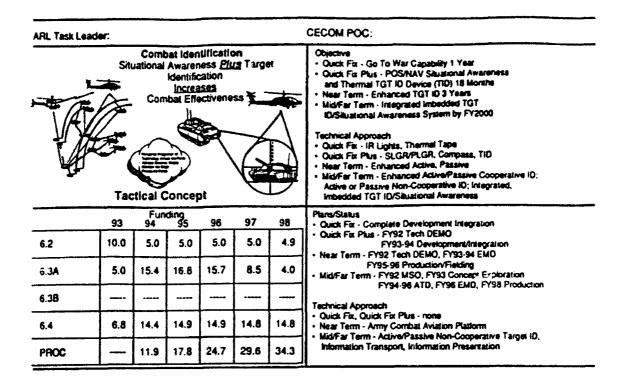


28 JAN 93

Combat ID Materiel Program Plan

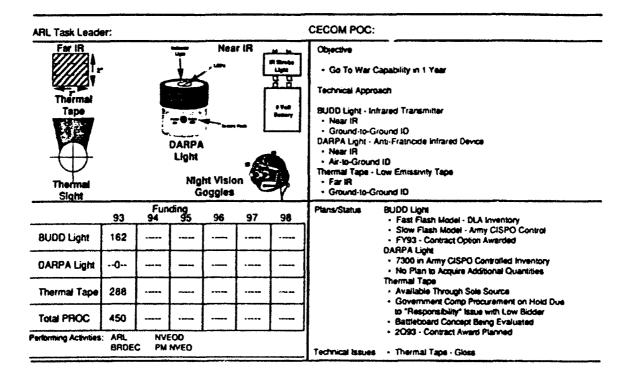


Battlefield Combat Identification Program Summary

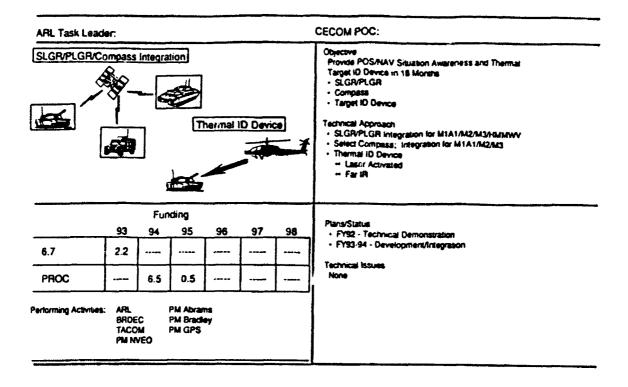


28 JAN 93

Battlefield Combat Identification Quick Fix

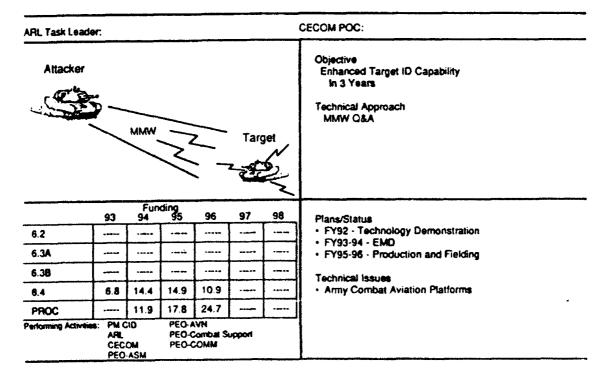


Battlefield Combat Identification Quick Fix Plus

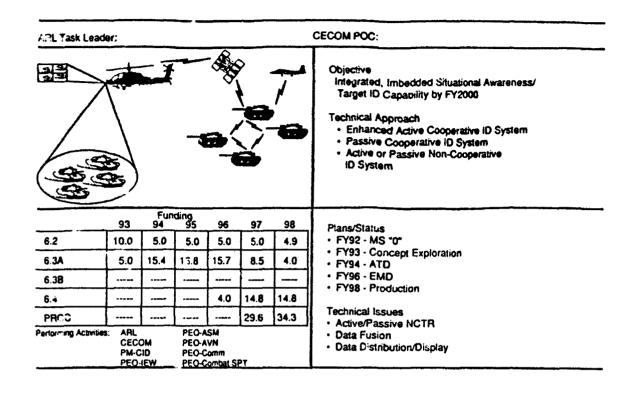


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Battlefield Combat Identification Near Term Program

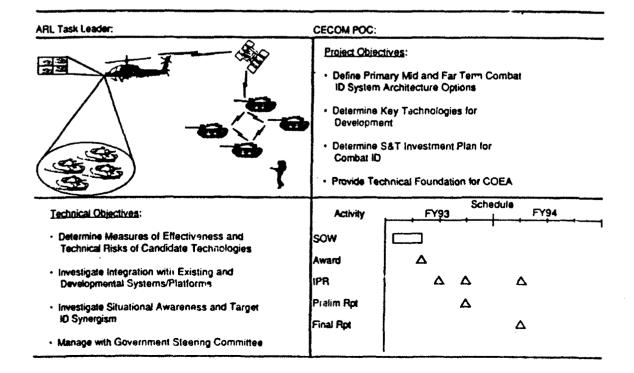


Battlefield Combat Identification Mid/Far Term Program



28 JAN 93

Architecture Study



Far Term CID Tech Base

Leverages Ongoing Technology Programs In: Automated Target Recognition Algorithms

- - · Acoustic
 - .. EO
 - · Radar
 - · Multi-Sensor
- Photonic Processing
- Scalable Digital Processing Architectures
- Advanced Sensor and Processor Component Technology
- Display Technology
- Human Factors Research
- LO Target Modelling

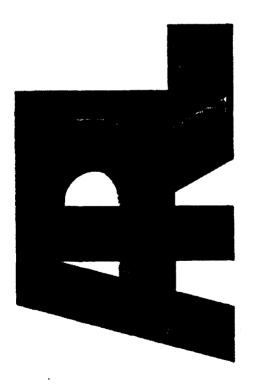
28 JAN 93

Summary

Combat ID Program Must:

- Provide Robust Combination of Integrated Target ID and Situational Awareness
- Develop Technologies Which Provide High Confidence and Low Vulnerability Solutions
- Provide Affordable Solutions Which Can Be Integrated Across the Force
- · Maximize Dual Use Capabilities (i.e. Acquisition, Survivability,
- Provide Tools Which Can Assess Operational Effectiveness of Potential Solutions

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Materials

Mr. Lawrence D. Johnson Directorate Executive Materials Directorate (MAT) (617) 923-5275

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MATERIALS DIRECTORATE - APBI OVERVIEW

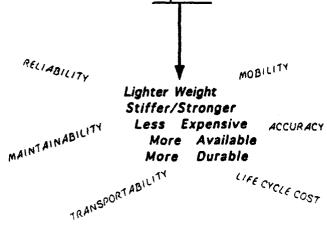
- MTL → ARL MATERIALS DIRECTORATE
- FUNDING PROFILE AND INVESTMENT STRATEGY
- WORKING TOGETHER
- TECHNOLOGY AREA HIGHLIGHTS
- "1-800-MATERIALS"



Mission

Materials Oirectorate

Provide the United States Army with a technology edge by research, development, processing and manufacturing technology, and standardization of superior materials.

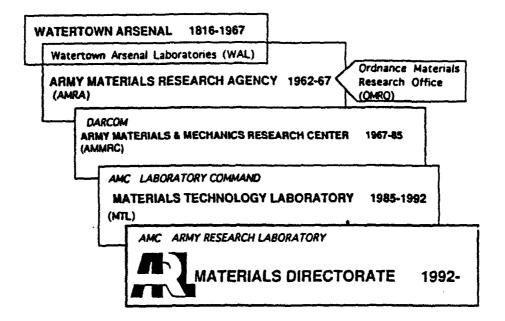




Army Materials Research--

Organizational History

Materials Directorate





MATERIALS DIRECTORATE - APB! TRANSITION

1993 - 1995

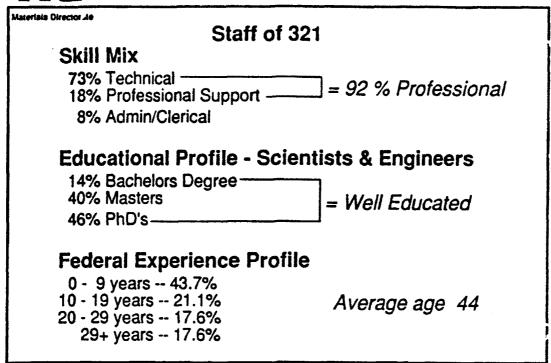
"YEARS OF CHANGE AND CHALLENGE"

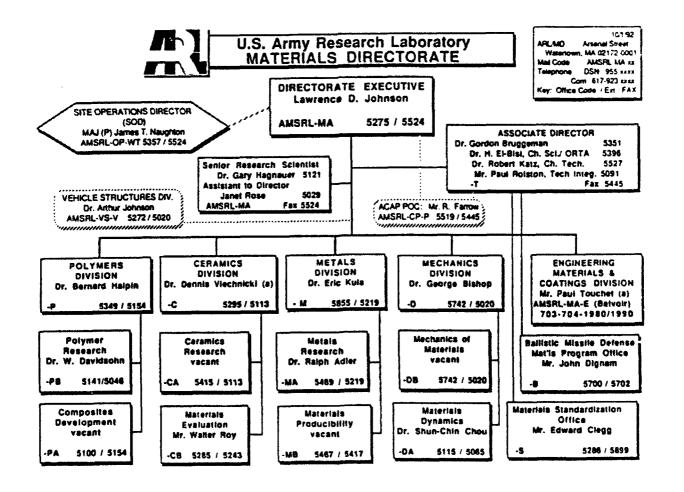
THE MATERIALS DIRECTORATE WILL:

- CHANGE ITS CORPORATE IDENTITY FROM MTL TO ARL
- CLOSE DOWN A MAJOR FACILITY (WATERTOWN)
- BUILD A NEW, WORLD CLASS LABORATORY (ABERDEEN)
- MAINTAIN AN ONGOING, HIGHLY FOCUSED, PRODUCTIVE IN-HOUSE AND EXTERNAL R&D PROGRAM WITHIN A HIGHLY CONSTRAINED BUDGET



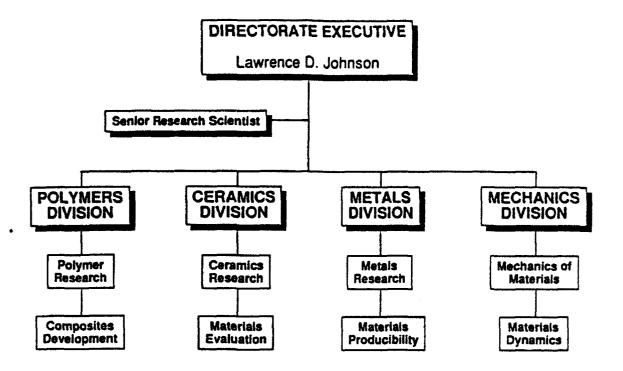
Assets: Personnel







U.S. Army Research Laboratory MATERIALS DIRECTORATE - End State





MATERIALS DIRECTORATE - APBI ANTICIPATED REVENUES (\$M)

	FY '93	FY '94	FY '95	FY '96
6.1	4.5	3.6	3.8	3.8
6.2	17.0	16.5	16.9	17.5
6.3	1.3	0	0	0
OTHER	3.8	3.8	3.7	3.9
CUSTOMER	6.3	7.3	4.9	4.4
(EXCLUDING DIRECT CITE CONTRACTS)	32.9	31.2	29.3	29.6

FY '93 - FY '96 ANTICIPATED EXPENDITURE PROFILE

84% IN-HOUSE

15% R&D CONTRACTS

1% OGA



MATERIALS DIRECTORATE - APBI

(BUSINESS AREAS)

AREA

- ARMOR/ANTI-ARMOR
- HI TEMPERATURE MATERIALS
- MATERIALS FOR LT. WEIGHT STRUCTURES
- ENVIRONMENTAL DURABILITY
- MATERIALS PROCESSING & MANUF. TECH.
- SPECIAL FUNCTION MATERIALS
 - CHEMICAL & LASER PROTECTION
 - SIGNATURE REDUCTION
 - EM & OPTICAL MATERIALS

AREA MANAGER(S)

DR. BISHOP/MR DOWDING

DR. FLETCHER

MR. HASKELL

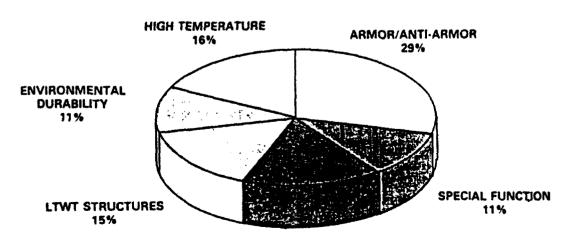
DR. HAGNAUER

DR. ADLER

DR. KATZ



MATERIALS DIRECTORATE - APBI FY '93 - '96 INVESTMENT STRATEGY BY BUSINESS AREAS



PROCESSING SCIENCE 17%

MATERIALS DIRECTORATE - APBI HOW TO WORK WITH THE MATERIALS DIRECTORATE

GIVEN AN ENVIRONMENT OF CONSTRAINED FISCAL RESOURCES - "HOW CAN WE WORK TOGETHER TO CONTINUE TO DEVELOP TECHNOLOGY FOR THE ARMY'S FUTURE?"

- CRDA's

 MATCH OUR STRENGTHS WITH YOUR NEEDS
- UNFUNDED STUDIES
 JOINT R&D PROJECTS EACH PARTY PERFORMS ITS PORTION AT ITS OWN EXPENSE (AUTHORITY AR-70, PARA 2-3)
- BAA
 TRADITIONAL CONTRACT MODE
- SBIR's
- UNIVERSITY INDUSTRY GOVERNMENT CONSORTIA (A MULTI PARTICIPANT VERSION OF THE UNFUNDED STUDY)

MATERIALS DIRECTORATE 1993 - APBI

HIGHLIGHTS OF THE TECHNICAL PROGRAM

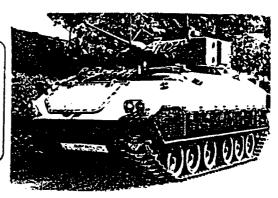


MATERIALS DIRECTORATE - APBI LIGHTWEIGHT STRUCTURES/PROCESSING **COMPOSITE HULL DEMONSTRATION PROGRAM**

SUCCESS TO DATE:

For Light-to-Medium Class (IFV) Hull

- · Completed materials development, FEA design, process identification, fabrication of IFV hull
- Completed static and dynamic test; outfitted and 6000-mi. field tested
- Delivered validated materials data package supporting CAV et al



RESULTS

LIGHTWEIGHT -25% weight savings for hull & armor

HIGHER SURVIVABILITY - 99% elimination of spall & better blast resistance

LOWER SIGNATURE & CREW STRESS -5-10 dBA less noise, less vibration

LESS LOGISTICS BURDEN/COST —lower maintenance than metals



MATERIALS DIRECTORATE - APBI LIGHTWEIGHT MATERIALS/PROCESSING **COMPOSITE HULL DEMONSTRATION PROGRAM**

SUCCESS TO DATE:

For Medium-to-Heavy (40-55 ton) Hull

- · Completed materials development, design, process ID
- Fabricated one heavy-class hull

FUTURE PLANS:



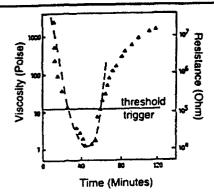
- Outfit and field test
- Transfer validated technology to TACOM/Industry



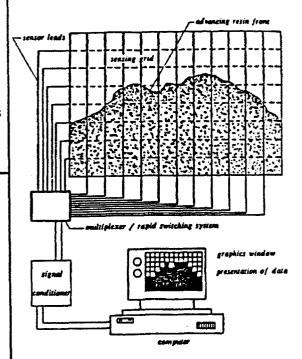
MATERIALS DIRECTORATE - APBI PROCESSING & MANUFACTURING TECHNOLOGY "SMART" WEAVE

SENSORS MOUNTED AS ROVING THREADS

- PROVIDES: 3-D FLOW & CURE MONITORING DURING RESIN TRANSFER MOLDING OF THICK SECTIONS
 - EMBEDDED SENSORS FOR IN-SERVICE
 - CONDITION MONITORING
- . TECHNOLOGY HAS BEEN DEMONSTRATED (GLASS FIBER PREFORM, C-FIBER GRID, POLYESTER)
- . PATENT HAS BEEN ALLOWED



U-SHAPED Q VS. t CURVE ENABLES CURE MONITORING



SHOWS FLOW MONITORING (MOLD FILL MONITOR) MODE (I.e., ADVANCING RESIN FRONT)



MATERIALS DIRECTORATE - APBI ARMOR I LO COST TI-ALLOY FOR ENHANCED COMPOSITE HULL

Titanium

Lightweight, 40% Lighter than Steel Low Cost, \$6 to \$7/Lb vs. \$20/Lb Ballistically Tolerant Structural Integrity No Major Technological Barriers Need To Optimize: **Ballistic Performance** Weldability Mechanical Properties

TURRET REPLACEMENT or APPLIQUE (KE, Fragment Defeat; Improved Shock Re COMMANDERS HATCH (Fregment and RE Deleat) RAMP REPLACEMENT or APPLIQUE INE and Fragment Dele ATTACHED APPLIQUE (KE Projectile Defeat) SPACED APPLIQUE PLATES (With Cerm HIT HEAT Defent)

Current Application

Commander's Hatch, BFV

Possible Applications Armor Structure Suspension System



MATERIALS DIRECTORATE - APBI ANTI-ARMOR TUNGSTEN PENETRATORS

OPPORTUNITIES/BENEFITS

- COST AVOIDENCE OF DU CLEAN-UP IN FUTURE ACTIONS (EST. COST OF \$1/2 BIL FOR KUWAIT)
- ELIMINATE ISSUES ASSOCIATED WITH MANUFACTURING & FIELDING α-EMITTING MATERIAL
- EQUAL BALLISTIC PERFORMANCE TO DU APPEAR TO BE ATTAINABLE

SHEAR LOCALIZATION (ADIABATIC SHEAR)



STATUS

- IMPORTANCE OF ADIABATIC SHEAR IN PENETRATOR PERFORMANCE IS UNDERSTOOD
- IDENTIFIED CANDIDATE W-COMPOSITE SYSTEMS TO PROMOTE ADIABATIC SHEAR
- NiFe12Al40 MATRIX PROMOTES HIGHLY LOCALIZED SHEAR IN TEST SAMPLES

NEEDS

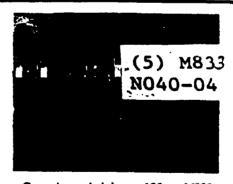
- LOW COST PROCESSES
- FULLY DENSE MATERIAL
- PROCESSING TECHNOLOGY FOR NON-TRADITIONAL W-ALLOYS & COMPOSITES



MATERIALS DIRECTORATE - APBI MATERIALS DURABILITY

CORROSION RESISTANT COATING FOR DU-3/4TI PENETRATORS

- •Potential applications: 919, 929 projectiles
- •Al-Zn Alloy deposited by cathodic arc plasma PVD
- •Provides galvanic protection to DU-3/4-Ti alloy
- ·Sacrifical coating can tolerate defects
- •Exhibits better mechanical strength, adhesion and cohesion, than the other leading candidate coating



Corrosion and pitting on 105mm M833 penetrator buttress grooves after 6 years of field exposure in European theater

COATING	COHESIVE LOAD	ADHESIVE LOAD
	Lc (N)	Lann
Al-Za	43.72	68.64
TIN-TI-TIN	27.18	32.55



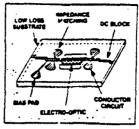
M919 DU-3/4-Ti penetrator coated with Al-Zn



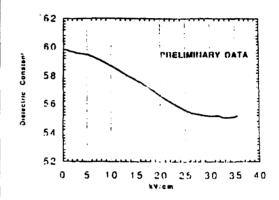
MATERIALS DIRECTORATE - APRI **MULTI-FUNCTIONAL MATERIALS** CERAMIC PHASE SHIFTER MATERIALS

- DEVELOPED A FAMILY OF CERAMIC COMPOSITES/DOPED BaxSryTiO3's WITH TAILORABLE DIELECTRIC PROPERTIES
- COMBINATION OF ε, tan d, TUNABILITY & REPRODUCIBILITY SUPERIOR TO PREVIOUS MATERIALS

- MAT-DIR IS: SUPPLYING MATERIALS TO **ESP-DIR FOR USE IN ELECTRO-OPTIC DISCRETE ELEMENT PHASE SHIFTERS**
 - SUPPLYING MATERIALS TO **CECOM FOR ANTENNA** DEVELOPMENT
 - APPLYING FOR PATENT
 - IN VARIOUS LEVELS OF CRDA **NEGOTIATION/DISCUSSIONS** WITH SEVERAL RADAR **MANUFACTURERS**



FROM BABBITT, KOSCICA, & DRACH MICROWAVE J., JUNE 1992, p-63





MATERIALS DIRECTORATE - APBI MULTI-FUNCTIONAL MATERIALS CHEMICAL PROTECTION

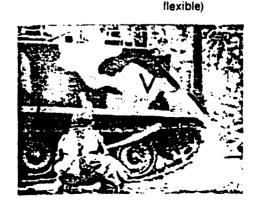


BARRIER MATERIALS	APPLICATIONS
POLYURETHANES	MASKS
POLYSILICONES	HOODS
BUTYL-RUBBERS	GLOVES
FL'IORO-ELASTOMERS	BOOTS
POLYMER-BLENDS	SEALS
	COATINGS (rigid&

PROGRAM FOCUS

EFFECTS OF CHEMICAL AGENTS AND DECONTAMINANTS ON PERSONNEL AND VEHICLE MATERIALS

DEVELOPMENT OF ADVANCED CLOTHING MATERIALS, PROTECTIVE COATINGS. NON-CORROSIVE DECONTAMINANTS AND SELF-DECONTAMINATING MATERIALS





MATERIALS DIRECTORATE - APBI GENERIC NEEDS

- QUALITY ASSURANCE & NDE TECHNOLOGY
- JOINING ESPECIALLY DISSIMILAR MATERIALS
- LOWER COST PROCESSING
- FUNDAMENTAL UNDERSTANDING OF MATERIALS DEFEAT MECHANISMS
 - BALLISTIC
 - CHEMICAL AGENT PERMEATION
 - WEAR & CORROSION
- REPAIRABILITY
- STANDARDIZATION

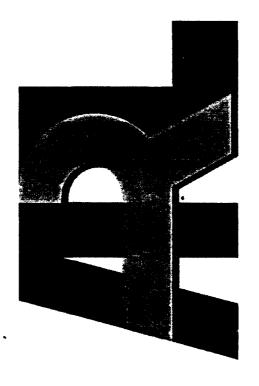


MATERIALS DIRECTORATE - APBI HOW TO REACH US: MA-D KEY STAFF

Mr. Lawrence Johnson Director	AMSRL-MA	(617) 923-5275
Dr. Gordon A. Bruggernan Associate Director	AMSRL-MA-T	(617) 923-535!
Dr. Hamid El-Bisi Chief Scientist (Tech Transfer POC)	AMSRL-MA-T	(617) 923-5396
Dr. Robert Nathen Katz Chief Technologist Multi-Functional Materials, Area Manager	AMSRL-MA-T	(617) 923-5527
Dr. Gary Hagnauer Sr. Scientist Materials Durability, Area Manager	AMSRL-MA	(617) 923-5121
Dr. George Bishop Chief, Mechanics Division Armor Materials, Area Manager	AMSRL-MA-M	(617) 923-5742
Dr. Bernard Halpin Chief, Polymers Division	AMSRL-MA-P	(617) 923-5349
Dr. Eric Kule Chief, Metals Division	AMSRL-MA-M	(617) 923-5469
Dr. Dennis J. Viechnicki Chief, Ceramics Division	AMSRL-MA-C	(617) 923-5295
Mr. John Dignam Chief, Ballistic Missile Defense Materials Office	AMSRL-MA-B	(617) 923-5519
Dr. Ralph Adler Processing & Manufacturing Science, Area Manager	AMSRL-MA-MA	(617) 923-5469
Mr. Robert Dowding Anti-Armor Materials, Area Manager	AMSRL-MA-MA	(617) 923-5340
Dr. Martha Fletcher di Temperature Materials, Area Manager	AMSRL-MA-C	(617) 923-5049
Vr. William Haskell .ightweight Structures, Area Manager	AMSRL-MA-PA	(617) 923-5172
Wr. Robert Morrise ^u SBIR Program Manager	AMSRL-CP-TT	(617) 923-5522

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Vehicle Propulsion

Mr. George A. Bobula Directorate Executive (acting) Vehicle Propulsion (VPD) (216) 433-3698

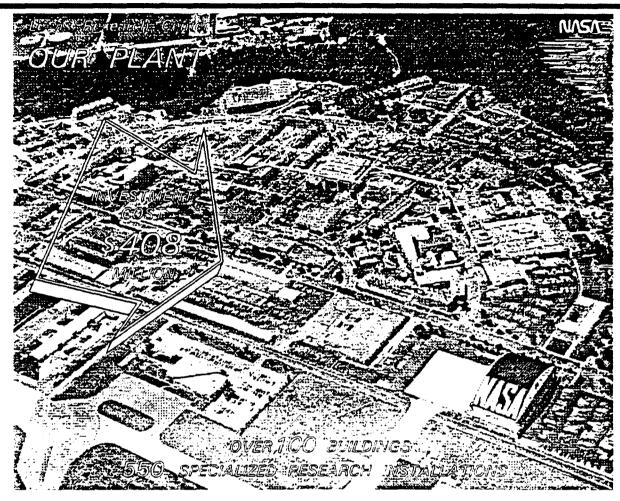
ADVANCED PLANNING BRIEFING for INDUSTRY

by George A. Bobula

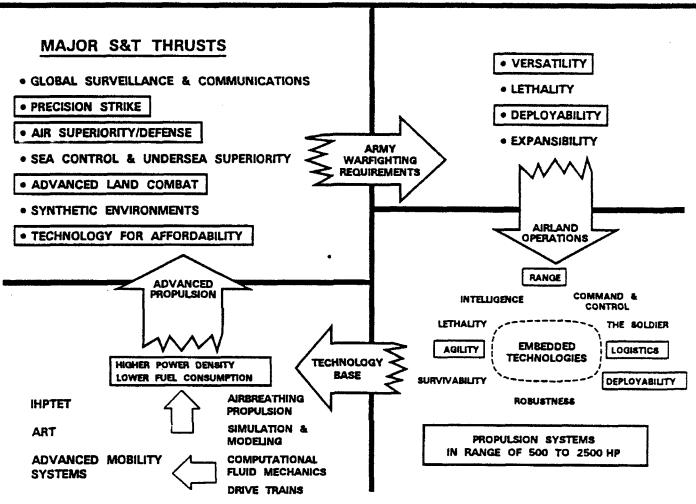




The Vehicle Propulsion Directorate, collocated at the NASA Lewis Research Center, has been the Army Aviation community's focal point for basic research and advanced development programs on gas turbine engines and power transmission systems. With its inclusion into the Army Research Laboratory complex, our mission has been expanded to include ground vehicle propulsion system research, already an element of our NASA host's mission. Our programs originate in a laboratory environment which has fostered the growth of recognized experts in their fields. Our established partnerships, providing access to world-class facilities, experts and capabilities, enables the VPD to fill the Army's vehicle propulsion research and technology niche.

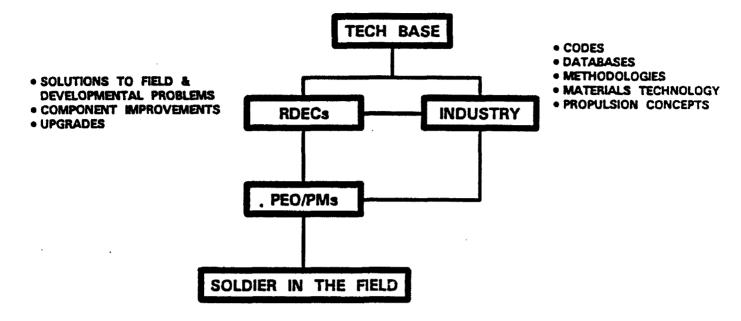


The Vehicle Propulsion Directorate is located at the NASA Lewis Research Center, adjacent to the Cleveland Hopkins Airport in Cleveland, Ohio. NASA Lewis, as part of its charter, defines and develops advanced technology directed at propulsion and power for application to aeronautics. As a result, the Vehicle Propulsion Directorate has at its disposal a significant portion of the more than 100 buildings and 550 specialized research rigs and internationally recognized researchers devoted to scientific and engineering research excellence. Since its founding in 1970, the VPD has emphasized interests of Army Aviation, due to our origination in the Army Aviation Research and Development community. The Directorate has, however, participated in propulsion work for other than air vehicles at the request of other government agencies and also through involvements with our NASA hosts. Under the Army Research Laboratory, our ground vehicle propulsion emphasis will grow. This has begun through expansion of existing NASA programs and resurrection of previous Propulsion Directorate activities.



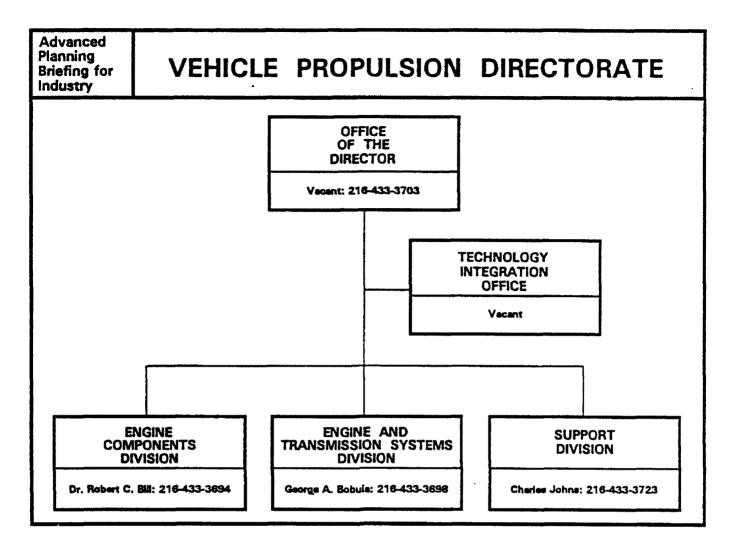
The work product of the Vehicle Propulsion Directorate is advanced propulsion technology derived through the conduct of a strong tech base program. Program drivers may be traced back through Airland Operation, to the Army Warfighting Requirements, and even to the major Science and Technology thrusts. The objective of advancing technology for higher power density and lower fuel consumption vehicle propulsion systems is addressed by conducting airbreathing propulsion and drive train research and development programs which support the goals of the Integrated High Performance Turbine Engine Technology (IHPTET) program, Advanced Mobility Systems and the Advanced Rotorcraft Transmission (ART) program.

ULTIMATE CUSTOMER IS THE SOLDIER



- PRIMARY TECH BASE PRODUCTS DISSEMINATED TO INDUSTRY VIA
 - INTERACTIVE PROGRAMS
 - CONFERENCES/SEMINARS
 - PUBLICATIONS
 - WORKING LEVEL COMMUNICATION

The ultimate customer of the Vehicle Propulsion Directorate is the soldier in the field. Our work product generally reaches the soldier from the PEO/PMs by way of the Research and Development Engineering Centers (RDECs) or the industry. The VPD traditionally works with the RDECs on the solution of field and developmental problems, component improvement activities and upgrades. Our involvement with industry is most often through shared links in the tech base programs, whether in the form of technical reports or in cooperative programs. On occassion, support is also provided directly to the PEO/PMs through participation on boards and assistance during system qualification programs.



The Vehicle Propulsion Directorate is structured as shown with two technical divisions, a support division and an integration office supporting the director. The Technology Integration Office, not yet staffed, will operate as the interface between the VPD and the RDECs. Their coordination will assist the directorate in establishing the direction of new technical programs. The Support Division provides administrative program management and technical program management services, as well as technical support, to ensure the continued conduct of a propulsion research activity at the VPD in concert with our NASA hosts. Technical programs are managed and/or conducted by individual Army scientists and engineers, from either the Engine Components Division or the Engine and Transmission Systems Division, operating within the framework of the NASA Lewis Research Center's organizational units. Technical activities range from analytical code development, analyses and investigations, to component testing, to complete system experiments in all areas relating to vehicle propulsion. Component and system experiments are performed in-house in NASA owned rigs. Programs are generally conducted with the investment of both Army and NASA resources.

Technical Areas of Interest

Small gas turbine engines Reciprocating engines Power transfer

Science & Technology Areas

Aerothermodynamic Components Rotating Reciprocating Static **Mechanical Components** Rotating Reciprocating Static **Propulsion Sciences Materials** Control Systems Systems (Engines/Drive Systems) Component Interactions System Phenomena **Unique System Configurations**

Specific Examples

- 2-stage, 5:1 CPR axial compressor
- Wave engine cycle
 3000°F CMC combustor
- Stability Enhancement
- Ceramic piston coatings
- Active vibration control
- Reconfigurable engine control
- Torque splitting transmissions
- Face gears
- Compound Cycle Engine

The Vehicle Propulsion Directorate plans, manages, and executes basic research and exploratory development programs of the Army Research Laboratory aimed at vehicle propulsion concepts, components, and systems technology. The programs are both in-house research and contracted activities. Significant activity and progress has been seen in gas turbine engine and power transfer technologies over the past 20+ years. Advances such as utilization of PMR-15, active compressor stabilization, compliant layer strain isolation in ceramic gas turbine shrouds and ceramic combustors, and test techniques to understand the effects of inlet temperature distortion on engine operation, among others, had their genesis under VPD/NASA-Lewis. Under ARL's banner, the same pressures that were exerted on aviation propulsion technologies will now be extended to ground vehicles.

FACILITIES USED IN ARMY PROGRAMS (OWNED BY HOST: NASA-LEWIS)

SOME SPECIAL EQUIPMENT AND FULL-SIZE HARDWARE FURNISHED BY THE ARMY

FACILITIES

SYSTEM LEVEL/MAJOR ITEMS

3000-5000 HP TRANSMISSION STAND 300-500 HP TRANSMISSION STAND ENGINE COMPONENTS RESEARCH LAB

PROPULSION SYSTEMS LABORATORY (*)

ICING RESEARCH TUNNEL (*)
1 x 1 SUPERSONIC TUNNEL

COMPONENT LEVEL

COMPRESSOR RESEARCH TURBINE RESEARCH COMBUSTOR RESEARCH LUBRICATION/TRIBOLOGY RESEARCH MECHANICAL COMPONENT RESEARCH

COMPUTATIONAL SCIENCES

FLUID MECHANICS/FLUID DYNAMICS DATA PROCESSING

COMMENTS

UH-60 & AH-64 SIZE
OH-58/AHIP SIZE
T55, T700, T800 SMALL TURBOSHAFT ENGINE
RESEARCH (STER) TEST BED
ALTITUDE AND DISTORTION TESTING IN SUPPORT OF
LH PEO/T800 QUALIFICATION
ROTORCRAFT SYSTEMS (BLADES, WEAPONS, INLETS)
SPECIAL TEST FOR PICATINNY (ARTILLERY ROUND)

- 3 RIGS (AXIAL, CENTRIFUGAL, AND MULTISTAGE)
- 2 RIGS (AXIAL, RADIAL)
- 4 RIGS (BASIC COMBUSTION SCIENCES AND SMALL COMBUSTORS)
- 12 RIGS (SURFACE SCIENCE, FRICTION, LUBRICATION, WEAR)
- 9 RIGS (GEARS); 5 RIGS (BEARINGS); 1 RIG (SEALS);
- 2 RIGS (CLUTCHES)

1 COMPRESSIBLE FLOW RIG; 1 TRANSONIC CASCADE RIG MAINFRAMES......2 CRAY (XMP & YMP); ALLIANT PARALLEL PROCESSOR; 2 AMDAHL; 2 IBM (3070 & 3090); 2 VAX CLUSTERS; TRANSIENT DATA ACQUISTION AND RECORDING

(*) CATEGORIZED AS NATIONAL FACILITY

All of the facilities used to conduct the Vehicle Propulsion Directorate program are owned by the NASA Lewis Research Center, our host. The facility assets run the full range of complexity from simple gear material fatigue rigs, requiring little operator interaction once the test specimen is installed, to complete engine system altitude chambers, requiring over a dozen operators. The facilities cover the full spectrum of experimental requirements for airbreathing engines and power transfer systems. State-of-the-art data acquisition and reduction capabilities are provided in most of the facilities along with all necessary test support hardware. Several recognized national facilities are included in this inventory.

WORK UNIT TITLE: Compressors - Large, Low-Speed Compressor Facility 61102/AH45 PE/PRJ: CONTRACTOR: In-house POC/PHONE: M. Hathaway (216) 433-6250 OBJECTIVE/PROBLEM STATEMENT: - Centrifugal compressor design capabilities are hampered by lack of understanding of the fundamental flow physics. Axial design/analysis methods are based on assumed asymmetric and steady flow conditions, while the actual flow for imbedded stages is ssymmetric and unsteady. **DELIVERABLES:** Detailed measurements of centrifugal flows (in the LSCC -Low-Speed Centrifugal Compressor) and axial flows (in the LSAC - Low-Speed Axial Compressor), leading to a more complete understanding of the relevant flow physics, and ultimately to improved design capabilities. Benchmark data for 3D viscous, steady and unsteady flow solvers now being developed Data for flow physics modeling PROGRAM SCHEDULE ACCOMPLISHMENTS: FY 90: - Completed LSCC rator only sero performance TASKS 92 93 94 95 96 surveys and diffuser exit flow visualization FY 91: - Completed LSCC rotor only laser and hot-wire anemometer measurements plus ammonia/ozalid ed resitiateon saint tenta flow visualization on blade surfaces FY 92: - Install LSAC and complete check-out/initial testing PLANS: Teat LSCC with rotor & diffu FY 93: - LSAC performance characteristics, hot-wire anemometry data, flow visualization on blade and endwall surfaces FY 94: - Rotating frame instrumentation fabrication and

measurement
- Investigate endwall mixing
FY 95: - Install and test LSCC with diffuser

The objective of the Large, Low-Speed Compressor research project is to obtain detailed measurements to: (1) improve our fundamental understanding of the unsteady flow physics which characterize blade row interactions in multistage compressors; and (2) aid in the development of closure models required for the Averaged-Passage approach to predicting multistage compressor flow fields. The LSAC is a four foot diameter, four-stage axial compressor with inlet guide vanes, and is patterned after the General Electric Low Speed Research Compressor. Both use a four-stage design and concentrate research in the third stage. The first two stages, preceded by a long inlet duct, build up thick endwall boundary layers and a representative multistage flow field, while the fourth stage buffers the third stage from the downstream diffuser and collector flow field. The LSAC became operational in June, 1992 and initial measurements were obtained. The results indicated the need for slight restaggering of the inlet guide vanes and the first stage rotor to achieve repeatable stage performance characteristics.

WORK UNIT TITLE: Compressors - Advanced Multi-Stage Small Axial Compressor
PE/PRJ: 62211/A47A

CONTRACTOR: Joint Program (Army/NASA/Allison)

POC/PHONE: G. Skoch (216) 433-3396

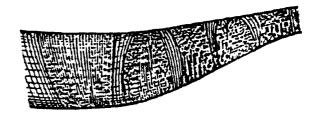
OBJECTIVE/PROBLEM STATEMENT:

- Develop a compression system that will meet IHPTET performance requirements
- Increased power/weight ratio and lower SFC from higher pressure ratios but fewer compressor stages

DELIVERABLES:

- An axial compression system that produces a pressure ratio of 5:1 using only two axial stages
- Validation of advanced analysis code for multi-stage configurations

SIMULATED AXIAL COMPRESSOR FLOW PATH



TASKS 90 91 92 93 94 95 Compressed associatives design Analysis using multi-stage everage patients odds Compresser mentional design Reducing of scalaring test rig running gear Test of new running gear Fabrication of test hardware Buildus of compresser test pushage Compresser performance testing Compresser leave surveys

ACCOMPLISHMENTS:

FY 91/ - Completed compressor aero design

FY92: - Completed 3D viscous flow analysis of the two stage compressor (operating in a true multi-stage

environment)
- Initiated fabrication of the test compressor

- Redesigned an existing axial compressor shaft and bearing support structure, to accommodate the

PLANS:

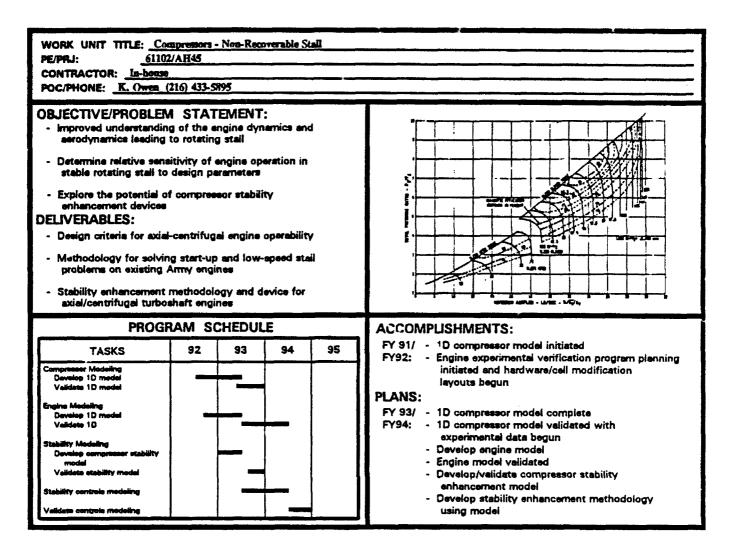
FY 93: - Testing of the redesigned running geer will

be completed

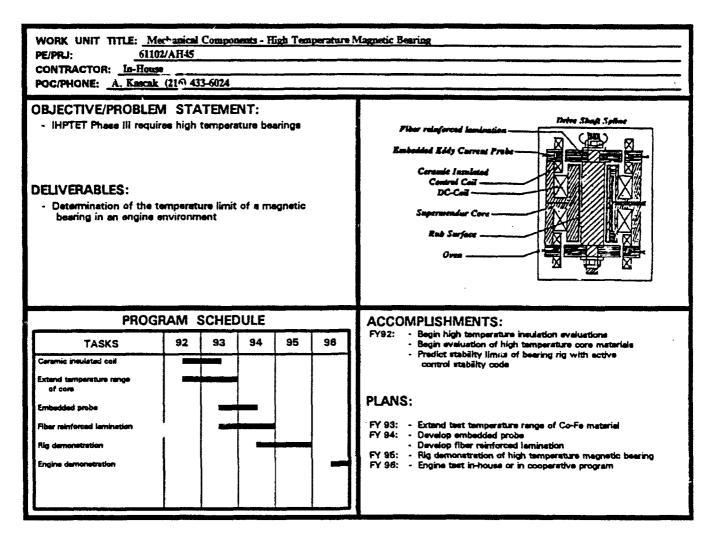
- Buildup of the test package will be completed

- Compressor testing will be initiated

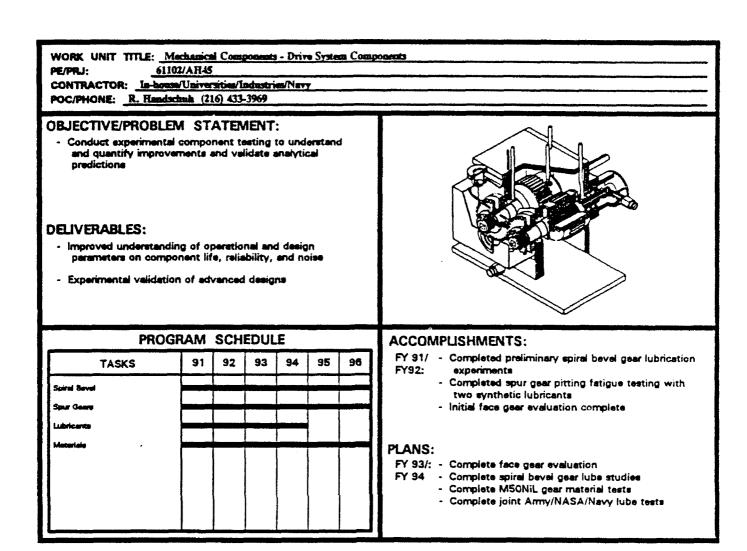
The 2-stage, 5:1 axial compressor program is a cooperative effort involving the U.S. Army Vehicle Propulsion Directorate, NASA Lewis, and the Allison Gas Turbine Division of General Motors. Multistage CFD analyses of two preliminary designs were conducted at Lewis under Army support, and recommended changes, based on the analytical resuts, were incorporated in the final detailed design. This compressor is expected to demonstrate the highest pressure ratio yet achieved (5:1) using only two axial stages, while maintaining efficiency and surge margin. Compressor hardware has been fabricated and delivered to Lewis Research Center for testing in the Small Compressor Test Facility. Facility modifications and instrumentation preparations are nearing completion. Testing is scheduled to commence during the second quarter of FY93.



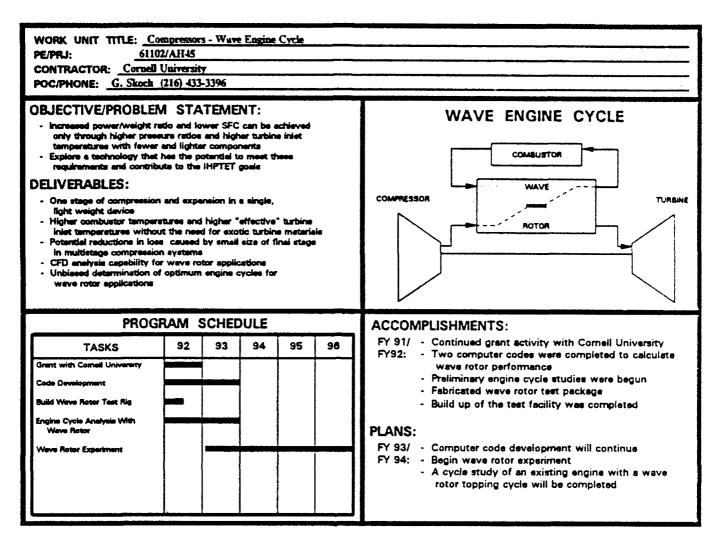
The Lycoming T55-L-712 turboshaft engine has experienced an intermittent stall problem since its entry into service. The VPD has initiated a detailed analytical/experimental program to define the nature of this stall problem and to explore corrective measures to prevent its occurrence in future engines. A dynamic compressor model has given preliminary indications that the problem exists in the first stage rotor. A grant continues with Virginia Polytechnical Institute for the development of an advanced post-stall modeling code. A joint three year effort has begun with AEDC (Arnold Engineering Development Center) to develop an advanced dynamic/transient engine model. Facility modifications for a 1993 in-house engine test, to be conducted as part of the Small Turboshaft Engine Research (STER) activity, have begun. Instrumentation of the test rig and the engine has also been started. A joint NASA/Army effort is underway to explore an advanced compressor stability enhancement concept for the T55-L-712 compressor. NASA will be involved in the controls development and MIT (Massachusetts Institute of Technology) will provide an appropriate compressor model.



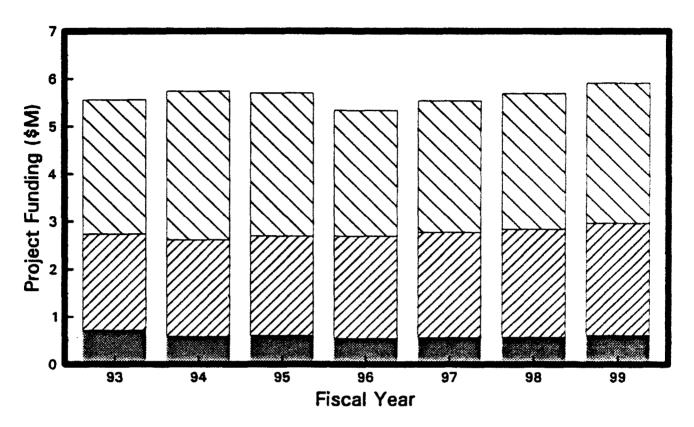
The objective of the IHPTET (Integrated High Performance Turbine Engine Technology) program is to greatly increase the performance, while simultaneously reducing the weight of conventional gas turbine engines. Magnetic bearings offer the opportunity to eliminate the lubrication system and oil seals, extend bearing life and DN (size*speed parameter), allow for adaptive vibration control, in addition to compatibility with the goal for all-electric engine accessories. The NASA Lewis Research Center and the Vehicle Propulsion Directorate have started a joint, high temperature magnetic bearings program, which will be investigating high temperature probes, compact wire insulation. and fiber reinforced laminates. High temperature materials and insulation testing has been started, as well as 3D magnetic bearing modeling. In addition, an in-house active control stability code has been used to predict the stability limits of the magnetic bearing rig. A cooperative program has been started between NASA/Army, Allison Gas Turbine Division, the University of Virginia. and Texas A&M University. It is a focused effort to build and test a 1000°F-1200°F magnetic thrust bearing.



A recent evaluation in the drive system components area investigated the feasibility of using face gears in a high-speed and high power environment such as found in rotorcraft transmissions. Helicopter transmissions are usually required to redirect the engine power output from the horizontal direction to the vertical in order to power the main rotor. This turning has traditionally been accomplished with spiral bevel gears. The use of face gears in this application (in a torque sharing arrangement) has been projected to reduce the main rotor transmission weight by up to 25 percent. Face gears, however, have previously been used only at low speeds and torques. In this effort, four half-scale face gear sets were tested in a closed-loop test stand at pinion rotational speeds to 19,100 rpm and to 271 kW (364 hp). All four sets of gears successfully ran at 100 percent of design torque and speed for 30 million pinion cycles, and two sets successfully ran at 200 percent of torque for an additional 30 million cycles. These results were a positive indication of the potential for using face gears in helicopter transmissions.



A joint NASA Lewis/Vehicle Propulsion Directorate program is underway to examine the wave rotor as a potential topping cycle for gas turbine engines, which would allow them to operate more efficiently at significantly higher pressures and temperatures. A wave rotor consists of many tubes placed around the outside of a rotating drum. The flow in each tube alternates between combustor gas and fresh air from a conventional compressor. When combustor gas enters the tube. it drives a shockwave through the fresh air, causing additional compression. The charge of highly compressed fresh air is then delivered to the combustor. The combustor gas still in the tube is exhausted by an expansion wave which forms to balance the energy that was used in compression. The expansion wave cools the combustion gas, so that it can be allowed to flow out through a conventional turbine. Because each tube is intermittently cooled by fresh air, very high combustion temperatures can be achieved without the use of complex cooling schemes. By replacing the high spool(s) of a gas turbine engine with a wave rotor, significant performance improvements could be achieved. Computer codes have been developed to predict the wave motion and performance of wave rotors. An experimental facility has been designed and constructed to verify code predictions. Initial results show very good agreement between experiment and prediction.



- Ground Vehicle Basic Research
- Aviation Basic Research
- □ Aviation Advanced Development

The Vehicle Propulsion Directorate is a relatively small organization. Thus, its budget is also small in comparison to other ARL directorates. The FY93 budget, after accounting for costs of opening our doors (e.g., salaries, travel, training, assessments,...) leaves approximately \$1.5M program funding. There is essentially no growth projected through FY99. Under ARL, our charter has been enlarged from its original aviation emphasis to include ground vehicle basic research. The funding projection related to ground vehicle propulsion basic research is constant. It has also been projected that staffing at the VPD will increase slightly, to deal with the new ground vehicle propulsion role. There is not sufficient funding to permit increasing the staff while also maintaining a vibrant, technology pushing program.

Cooperative Research and Development Program with Industry

- SHARING OF EACH OTHER'S CAPABILITIES, IDEAS, AND RESOURCES TO ACHIEVE COMMON OBJECTIVES
- NO FUNDS EXCHANGE HANDS
- BENEFITS TO THE ARMY PROPULSION COMMUNITY
 - LEVERAGES NASA AND INDUSTRY RESOURCES
 - MINIMIZES ARMY COST FOR TECHNOLOGY DEVELOPMENT
 - PERMITS US TO DO TOGETHER, WHAT OTHERWISE COULD NOT BE DONE ALONE

CONDUCTED UNDER NON-REIMBURSABLE SPACE ACT AGREEMENT

Being used with increasing frequency in the present financial atmosphere

The Vehicle Propulsion Directorate has been entering into an increasing number of cooperative research and development programs with industry in the past few years. These programs are conducted under non-reimbursable space act agreements, wherein the parties share with each other their capabilities, ideas, and resources to achieve common objectives. No funds are exchanged. Rather, the parties contribute to the common task what they can best bring to the program. Generally, the Army's contribution is an analytical effort or test activity in one of our unique facilities. Industry's contribution is generally in the form of design and manufacture of hardware. In this way, the Army, NASA Lewis and industry leverage each other and minimize the cost to any one party for technology development. We accomplish together what none of us could accomplish alone.

PROPOSED SBIR TOPICS FOR FY93

- Advanced High Temperature Strain Isolator Material System
- Depleted Oxygen Gas Turbine Combustor Design
- Brush Seal Shaft Wear Resistant Coating
- Electromotive Propulsion Concepts for Rotorcraft
- Fast Acting Valves for Turbomachinery Bleed Applications

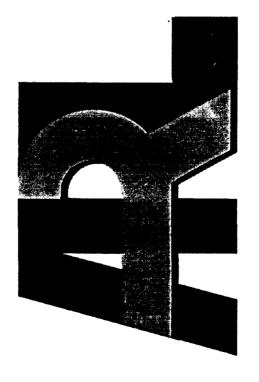
POC for SBIR activities: Mr. Pete Meitner, 216-433-3715

Another medium for pursuing tech base programs is through Small Business and Innovative Research programs. The topics proposed by the Vehicle Propulsion Directorate for solicitation in FY93, which have a reasonable chance for being solicitated, are listed in the figure.

SUMMARY

- VPD CONDUCTS A TECH BASE PROGRAM THAT IS DRIVEN BY THE NEEDS OF THE SOLDIER
- RESOURCES, (SPECIALISTS AND FACILITIES) FOR ALL ENGINE AND TRANSMISSION TECHNOLOGIES PROGRAM CONDUCTED USING WORLD CLASS
- VPD HAS ESTABLISHED A CENTER OF EXPERTISE FOR VEHICLE PROPULSION THAT IS SOUGHT BY OTHERS (CONSULTATION, COOPERATION,)
- PROGRAM WITH AVAILABLE RESOURCES USING ANY VPD WILL CONTINUE TO CONDUCT A VIBRANT **VEHICLE AT OUR DISPOSAL**

LABORATORY SEARCH Ш Œ ARMY



Environment

COL Ronald L. Evans
Directorate Executive
Battlefield Environment (BE)
(505) 678-1225



Battlefield Environment Directorate

Director

Battlefield Atmospheric Simulation

Atmospheric Assessment

Battle Weather Data Acquisition & Processing

Atmospheric Mitigation & Exploitation

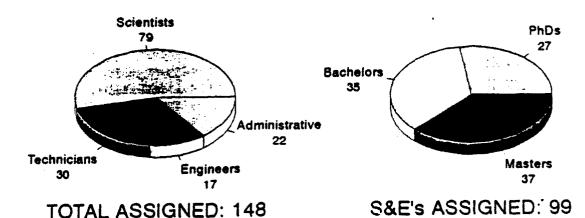
- Microscale models
- Atmosphere/ terrain interface
- Transport & diffusion
- War games
- Impact of atmosphere on combat material
- Analysis & assessment
- Field test support
- Exploit data sources
- Atmospheric sensors
- Data fusion/ processing
- Artillery meteorology

- Weather effects decision aids
- Propagation models
- Acoustics
- Electro-optics



Battlefield Environment Directorate Mission

- Develop <u>battlefield atmospheric modeling and simulation</u> capabilities to represent battlefield atmospheric conditions.
- Investigate <u>aerosol physics</u> properties related to the propagation of electromagnetic energy through battlefield atmospheres contaminated by natural and combat induced obscurants.
- Research and develop <u>atmospheric characterization</u> techniques and instrumentation, assess the susceptibility of Army materiel and operations to atmospheric conditions, and support such assessments as required.
- Research, develop, and exploit <u>atmospheric sensing</u> technology to collect battlefield weather data, including remote detection of various aerosol and gaseous components in the atmosphere.
- Develop <u>battle weather data processing</u> techniques for quantifying the meteorology over the battle area.
- Create methods and techniques to <u>mitigate</u> effects of battlefield atmospheres on friendly materiel and operations and <u>exploit</u> the knowledge of atmospheric effects on threat systems.



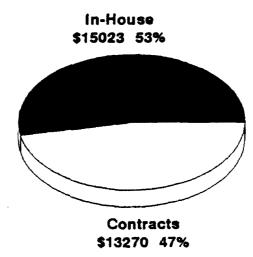
31 Dec 92



OVERALL FUNDING STATUS (\$K)

CATEGORY	FY92	FY93	FY94	FY95	FY96
BASIC RESEARCH (6.1)	5311	. 5654	6153	6431	6469
EXPLORATORY DEVELOPMENT (6.2)	4953	5895	6396	7074	7046
MET EFFECTS ASSESSMENT (6.5)	9936	9552	9922	9578	8663
SMALL BUSINESS INNOVATION RSCH (6.5)	1045	1065	TBO	TBD	TBD
OTHER	308	IBD	IBO	IBO	IBD
SUBTOTAL	21553	22168+	22471+	23083+	22178+
CUSTOMER	6740	IBD	TBD	TBD	TBO
TOTAL	28293	22166+	22471+	23083+	22178+

Subject to change based upon DoD and Congressional action



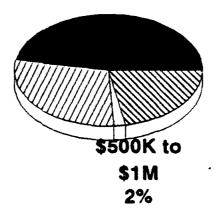
TOTAL: \$28,293 K



ACTIVE CONTRACTS FY 92

\$25K to \$100K 47%

\$100K to \$500K 29%



Greater than \$1M 22%

BATTLEFIELD ATMOSPHERIC SIMULATION FUTURE EFFORTS

FY94

- Weather/Obscuration Effects in Wargames
 - -- 4D Weather & Obscuration
- Transport & Diffusion
- Optical Simulator for Real Time Turbulence Effects

FY95

- Battlefield Obscuration Modeling
 - -- Exotic Battlefield Aerosols
 - -- Artificial Fogs
- Enhanced Physical Basis for Optical Turbulence Simulator

. FY96

- Miniaturized Real Time Optical Turbulence Simulator for General Army Applications

POC: Dr. D. Brown
Phone 505-678-2412, Fax 505-678-2053
AMSRL-BE-S, White Sands Missile Range, NM 88002-5501



ATMOSPHERIC ASSESSMENT FUTURE EFFORTS

- FY94
 - Upper Atmospheric Models for Theater Missile Defense
 - Millimeter Wave Imager Capability
 - Electro-Optical Systems Performance Models
- FY95
 - Mobile Spectroscopy Facility
 - Characterization of Tailored Broad Band Screeners
- FY96
 - Validation and Verification of EOSAEL models
 - Obscurant Characterization by LIDAR
 - Smoke Cloud Tomography
- * Continuing Support to Atmospheric Characterization (Smokes, Obscurants, etc.)

POC: Mr. D. R. Veazey
Phone 505-678-3331, Fax 505-678-7919
AMSRL-BE-A, White Sands Missile Range, NM 88002-5501

BATTLE WEATHER DATA AQUISITION & PROCESSING FUTURE EFFORTS

FY94

- UltraViolet Chem-Bio Warfare Detection Techniques
- SATCOM Weather Broadcasting Tech Demonstration
- Mobile Profiler Technology Demonstration
- Technology for Deriving Atmospheric Profiles from Multi-frequency Sensors
- Computer Assisted Artillery Meteorology for Tech Demonstration

• FY95

- Improved Data Acquisition/Distribution/Forecaster Aid Software
- 12-Hr Target Area Meteorology Forecasting Capability

FY96

- Prototype Horizontal Path Adaptive Optics Technology
- Non-hydrostatic Battle Scale Forecast Model on Army Tactical Command & Control System (ATCCS) Common Hardware/Software

POC: Dr. M. A. Seagraves
Phone 505-678-1339, Fax 505-678-3385
AMSRL-BE-W, White Sands Missile Range, NM 88002-5501



ATMOSPHERIC MITIGATION & EXPLOITATION FUTURE EFFORTS

• FY94

- Two Stream Acoustic Propagation Model
- Characterization Techniques for Weather Effects on Camouflage

FY95

- Advanced Electro-Optical Target Acquisition Model
- Aerial Intelligence Preparation of the Battlefield Automation
- Weather Decision Aids on Portable Weather Workstation

• FY96

- 3-D Two-way Acoustic Propagation Model
- Real-time Obscurant Scene Visualization

POC: Dr. F. E. Niles
Phone 505-678-3721, Fax 505-678-8366
AMSRi.-BE-M, White Sands Missile Range, NM 88002-5501



Battlefield Environment Directorate

Potential CRDA Areas

- Atmospheric Numerical Modeling
- Atmospheric Remote Sensing

Some Recent SBIR Efforts

- Portable FM-CW Doppler Radar to Provide Meteorological Data
- Water and Temperature Profiles in the Turbulent Surface Layer
- Acoustic Scattering by a Vortex Model of Turbulence
- Saltation & Suspension of Sediment by Turbulent Wind
- Atmospheric Boundary Layer Stability Estimator for Urban Areas
- Four Dimensional Mesoscale Non-Gaussian Multispectral Smoke Model

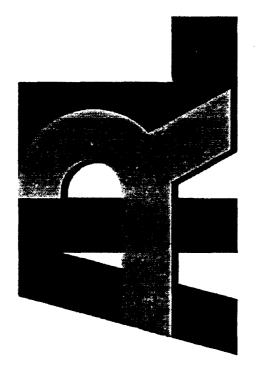


BATTLEFIELD ENVIRONMENT DIRECTORATE Points of Contact

White Sands Missile Range, NM 88002-5501

SUBJECT	POC	OFFICE SYMBOL	PHONE
Small Business	Mr. Luis Sosa	STEWS-SA-B	(505) 678-1401
SBIR	Mr. Odell Johnson	AMSRL-CP-TT	(505) 678-3608
HBCU/MI	Mr. Odelf Johnson	AMSRL-CP-TT	(505) 678-3808
Tech Transfer/CRDA	Mr. Odell Johnson	AMSRL-CP-TT	(505) 678-3608
Unsolicited Proposals	Mrs. Maria Brisano	AMSRL-OP-PR	(505) 678-2617
Contracting	Mrs. Barbara Gerace	AMSRL-OP-PR	(505)678-8110
Public Affairs	Mrs. Ann Rider	AMSRL-CP-S	(505) 678-3652
Competition Advocate	Mrs. Barbara Gerace	AMSRL-OP-PR	(505) 678-8110

LABORATORY SEARCH Ш Œ ARMY



Electronics & Power Sources

Dr. Clarence G. Thornton Directorate Executive Electronics and Power Sources (EPSD) (908) 544-2541





ELECTRONICS and POWER SOURCES

ARL APBI

NAVAL SURFACE WARFARE CENTER WHITE OAK, MARYLAND

PRESENTED BY:

DR. C.G. TKORNTON
DIRECTORATE EXECUTIVE
ELECTRONICS and POWER SOURCES DIRECTORATE
U.S ARMY RESEARCH LABORATORY
FORT MONMOUTH, NEW JERSEY

28 JANUARY 1993



ELECTRONICS and POWER SOURCES BUSINESS AREAS



ELECTRONICS and POWER SOURCES

MICROWAVE/MILLIMETER/MIMIC DEVICES

ACOUSTO/FERROELECTRONICS

NANO/OPTOELECTRONIC/PHOTONIC DEVICES

OPTICAL MATERIALS/DEVICES AND FOCAL PLANE ARRAYS

ADVANCED SENSOR/ACTUATOR DEVICES

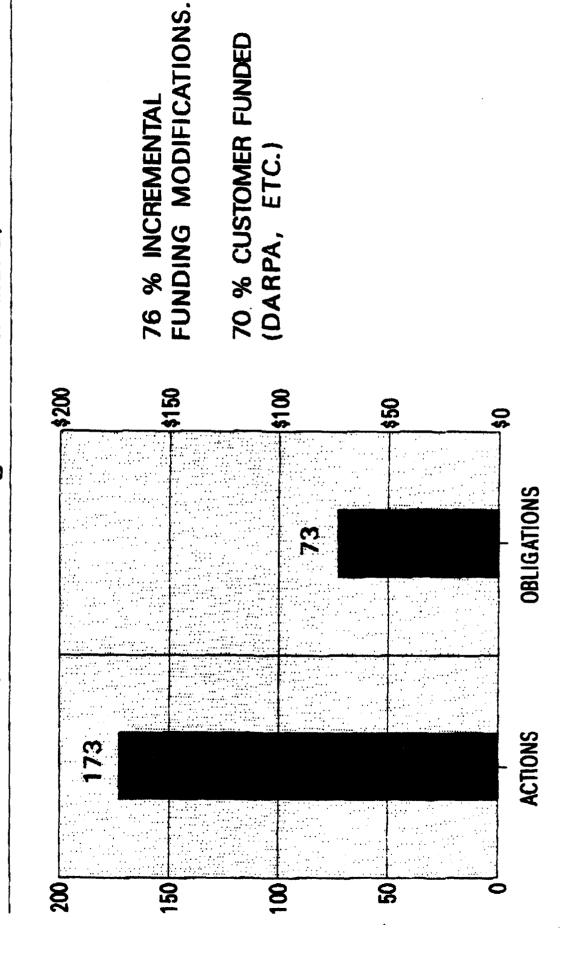
DESIGN/SIMULATION, MODELING, CONCURRENT ENGINEERING, AND PROTOTYPING

RELIABILITY AND MANUFACTURING SCIENCE

POWER SOURCES (INCLUDING PULSE POWER)

VIRTUAL ENVIRONMENT (DISPLAY) DEVICES

EPS Directorate
FY 93 Acquisition Plan
(Estimated obligations in millions)



158

ELECTRONICS AND POWER SOURCES FUTURE DIRECTIONS

PAST	PRESENT	FUTURE
MICROELETTRONICS>	> MICRO/QUANTUM> ELECTRONICS	NANOELECTRONICS (Quantum Transport, Alomic Transitions Mesoscopic, 30, Multi-Material, Manufacturing Science)
MICROWAVE/ MILIMETER-WAVE	MICROWAVE/MILLIMETER-WAVE -> DEVICES, IR ARRAY TECHNOLOGY, MIMIC DEVICES	MTEGRATED MW/MWW/PHOTONIC (Multimode Focal Plane, Smart/Adaptive)
DISPLAYS>	NFORMATION INTERFACE	VIRTUAL ENVIRONMENT DEVICES (Micro, High Definition, Retinal, Large Screen)
POWER SOURCES> PULSE POWER	POWER SOURCES>	ALTERNATIVE ENERGY SOURCES (Mini-Fuel Celle, Micro-Generators, SMEPS, Hi-Deneity Energy Storage)
PHOTONICS>	OPTOELECTRONICS, OPTICAL> MATERIALS, FOCAL PLANE ARRAYS	INTEGRATED MICROPHOTONIC DEVICES (OICs, Optical Devices/ Bench-on-s-Chip, Smart Pixels)
FREQUENCY CONTROL/> ACOUSTICS	MAGNETICS FERROELECTRONICS	MICROSENSOR/ACTUATOR/ CONTROL DEVICES (Microelectromechanical, Bloelec-
grandorstagner.	BIO SENSORS SUPERCONDUCTORS	tronic and Magnetic, Ferroelectronic Superconductivity)



ELECTRONICS and POWER SOURCES
FY93 PROGRAM

1 JANUARY 1993

US ARMY



MAJOR NEW PROGRAM INITIATIVES



ELECTRONICS and POWER SOURCES

- . MIMIC PHASE II
- MICROWAVE ANALOG FRONT-END TECHNOLOGY (MAFET)
- RAPID PROTOTYPING OF APPLICATION SPECIFIC SIGNAL PROCESSORS (RASSP)
- MICROWAVE HARDWARE DESCRIPTION LANGUAGE (MHDL)
- APPLICATION-SPECIFIC ELECTRONIC MODULES (ASEM)

-



HIGH LEVERAGE PIVOTAL TECHNOLOGY



ELECTRONICS and POWER SOURCES

MICROWAVE/MILLIMETER/MIMIC DEVICES

- INTEGRATED PHOTONIC MMIC's
- QUASI-OPTICAL MILLIMETER WAVE ELECTRONICS
- MICROWAVE/MILLIMETER WAVE IMAGING TECHNOLOGY
- PHYSICS BASED MODELLING OF MW + PHOTONIC DEVICES
- MICROWAVE HARDWARE DESCRIPTION LANGUAGE (MHDL)
- MICROWAVE/MILLIMETER WAVE RELIABILITY

ACOUSTO/FERROELECTRONICS

- SURFACE ACOUSTIC WAVE DEVICES
- FERROELECTRONIC DEVICES
- LOW-NOISE/VIBRATION-IMMUNE CRYSTAL OSCILLATORS
- MICROSENSORS

DESIGN/SIMULATION, MODELING, CONCURRENT ENGINEERING AND PROTOTYPING

- ELECTRONIC MODULES & COMPONENTS
- DEVICES AND PROCESSING
- PACKAGING

CPTVOTT TORKPORT-MANYSH



HIGH LEVERAGE PIVOTAL TECHNOLOGY



ELECTRONICS and POWER SOURCES

DEVICE RESEARCH

- NANO/OPTOELECTRONIC/PHOTONIC DEVICES
- OPTICAL MATERIALS/DEVICES AND FOCAL PLANE ARRAYS
- ADVANCED SENSOR/ACTUATOR DEVICES
- INFRARED DETECTOR TECHNOLOGY
- HIGH TEMPERATURE SUPERCONDUCTING DEVICES
- PERMANENT MAGNET DESIGN

RELIABILITY AND MANUFACTURING SCIENCE

POWER SOURCES (INCLUDING PULSE POWER)

- HIGH-RATE, HIGH-ENERGY, ENVIRONMENTALLY-BENIGN THROWAWAY BATTERIES
- HIGH-ENERGY RECHARGEABLE (MULTICAPABLE) BATTERIES
- ADVANCED ENERGY STORAGE CONCEPTS
- HIGH-ENERGY, HIGH-REP RATE CAPACITORS
- . HIGH-REP RATE, HIGH-ENERGY PULSER SWITCHES
- HIGH-ENERGY PULSER COMPONENTS

HEPTSON 1990 APRIL 30-45VA



HIGH LEVERAGE PIVOTAL TECHNOLOGY



ELECTRONICS and POWER SOURCES

VIRTUAL ENVIRONMENT (DISPLAY) DEVICES

- ELECTRONIC MODULES AND HIGH RESOLUTION DISPLAY COMPONENTS
- HI-RESOLUTION MULTICOLOR DISPLAYS

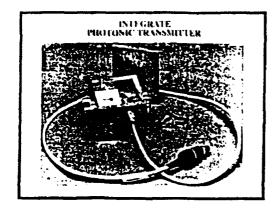
HEPTROITIES/APRILI-28-63/SP

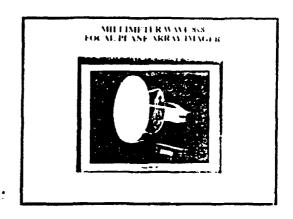
MIMIC PROGRAM STATUS (January 1993)

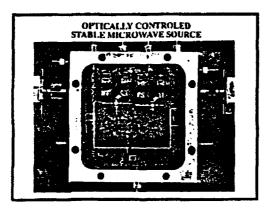
- PHASE 1 93 UNIQUE CHIPS FOR 20 MILITARY SYSTEMS DESIGNED AND 60% RF FUNCTIONAL ON FIRST ITERATION
- PHASE 2 76 COMPLEX CHIPS FOR MORE THAN 20 PRIMARY APPLICATIONS ARE BEING DEVELOPED
- ADVANCED POWER PROCESSES (HBT, HFET AND PHEMT) ARE INTRODUCED FOR HIGH PERFORMANCE (MORE THAN 10% EFFICIENCY IMPROVEMENT, 1W POWER AT Ka BAND AND 100 mW AT W BAND
- HBT TECHNOLOGY UTILIZED FOR LOW PHASE NOISE VCO APPLICATIONS
- MAJOR IMPROVEMENT IN FIRST PASS DESIGN HAS BEEN DEMONSTRATED DURING PHASE 2 BY USING CAD TOOLS (DESIGN CENTERING, EM SIMULATION, ETC.) AND IMPROVED MODELS
- DISTRIBUTED RELATIONAL DATA SUPPORTS DESIGN, PROCESSING AND TESTING FOR IMPROVED PRODUCIBILITY
- MAJOR IMPROVEMENT IN ON-WAFER TESTING (FROM 5 hours, TO 6 minutes EXTENDED TO ON WAFER TEMPERATURE TESTING, AUTOMATED PULSED RF POWER TESTING AND TO HIGHER FREQUENCIES AT W BAND)
- COST OF QUALIFIED CHIPS REDUCED FROM \$500 TO \$8 PER MM SQUARE
- MORE THAN 100 CHIP TYPES DEVELOPED UNDER THE MIMIC PROGRAM OFFERED FOR SALE

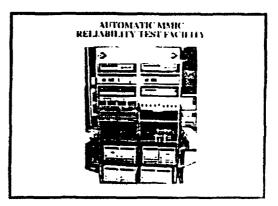
MPS/010693/AP(N(1-14-93)/SP

MICROWAVE/MILLIMETER WAVE









MICROWAVE/MILLIMETER WAVE DEVICES

TECHNOLOGY AREAS OF INTEREST

- . INTEGRATED PHOTONIC MMIC's
- QUASI-OPTICAL MILLIMETER WAVE ELECTRONICS
- MICROWAVE/MILLIMETER WAVE IMAGING TECHNOLOGY
- PHYSICS BASED MODELLING OF MW + PHOTONIC DEVICES
- MICROWAVE HARDWARE DESCRIPTION LANGUAGE (MHDL)
- MICROWAVE/MILLIMETER WAVE RELIABILITY

OBJECTIVES:

- MEET PERFORMANCE REQUIREMENTS OF MW/MMW ELECTRONICS FOR MISSILE GUIDANCE, RADAR, JAMMERS, AND SENSORS.
- DEVELOP OPTICAL/MW ICS FOR DISTRIBUTION OF CONTROL SIGNALS FOR NEXT GENERATION ACTIVE PHASED-ARRAY RADAR AND COMMUNICATIONS.
- DEVELOP MODELING AND SIMULATION TECHNIQUES FOR MW/MMW DEVICES AND PROCESSES.

DESIGN/SIMULATION, MODELING, CONCURRENT ENGINEERING

TECHNOLOGY AREAS OF INTEREST

ELECTRONIC MODULES & COMPONENTS

RAPID PROTOTYPING OF APPLICATION - SPECIFIC SIGNAL PROCESSORS (RASSP)
APPLICATION-SPECIFIC ELECTRONIC MODULES (ASEM)
DIRECT DIGITAL SYNTHESIZERS
NEURAL NETWORKS

- DEVICES AND PROCESSING
 - SILICON TECHNOLOGY

III - V DEVICES

- PACKAGING
 - 3-DIMENSIONAL PACKAGING HIGH-POWER-MICROWAVE-IMMUNE PACKAGING

OBJECTIVE:

- MAINTAIN Dod S&T LEAD IN APPLICATION OF THE NEXT MAJOR ADVANCES IN MICROELECTRONICS, REDUCING SIZE & WEIGHT BY A FACTOR OF 20 WHILE INCREASING THROUGHPUT TO MULTI-GIGAFLOP LEVELS. IMPLEMENT THE ARMY PORTION OF THE RASSP AND ASEM PROGRAMS.
- ACHIEVE FAILURE-FREE MICROELECTRONICS.

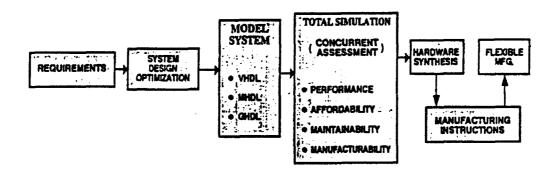
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DESIGN/SIMULATION, MODELING, CONCURRENT ENGINEERING



ELECTRONICS and POWER SOURCES



RAPID PROTOTYPING OF APPLICATION SPECIFIC SIGNAL PROCESSORS (RASSP)

DBMCE/910092/APR(1-10-93)/2F

VIRTUAL ENVIRONMENT (DISPLAY) DEVICES

TECHNOLOGY AREAS OF INTEREST

- ELECTRONIC MODULES AND HIGH RESOLUTION DISPLAY COMPONENTS
- . HI-RESOLUTION MULTICOLOR DISPLAYS

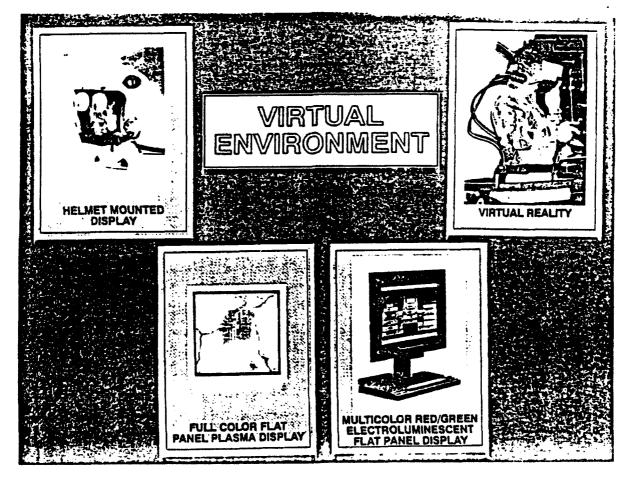
OBJECTIVE:

- PROVIDE SOLDIER/DISPLAY INTERACTIVE INTERFACES TO SERVE AS A FORCE MULTIPLER IN INFORMATION INTENSIVE BATTLEFIELD APPLICATIONS.
- DEVELOP PROTOTYPE, HIGH-RESOLUTION, RUGGED, LOW POWER, DISPLAY PANELS IN SIZES RANGING FROM MINIATURE PERSONAL VIEWERS TO LARGE LCREEN DISPLAYS
- DEVELOP, DEMONSTRATE, AND EVALUATE PROTOTYPE MULTICOLOR, HIGH RESOLUTION FLAT PANEL INTERACTIVE DISPLAYS FOR MAN PORTABLE, VEHICLE, AIRCRAFT AND GROUND APPLICATIONS

PRINCIPAL USERS:

- CENTERS/LABS: CECOM, MICOM, TACOM, CACDA, HEL, NAVY, AIR FORCE, MARINES
- . PMs: AMMOLOG, TMDE, OPTADS, AFATDS

DISPLAYING10083/APBI(1-20-63)/257/SF



ACOUSTO/FERROELECTRONICS

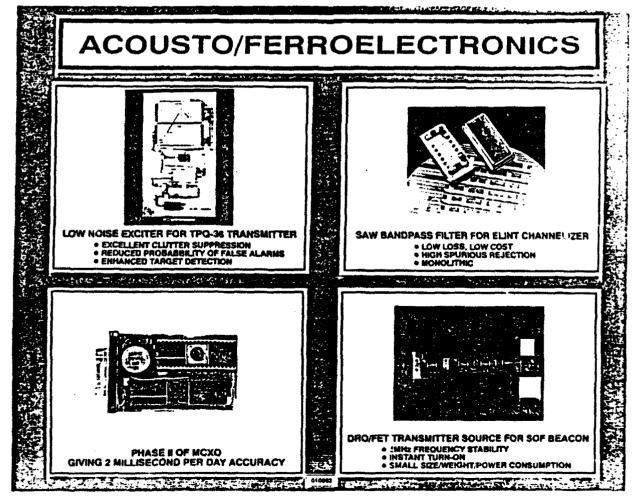
TECHNOLOGY AREAS OF INTEREST

- SURFACE ACOUSTIC WAVE DEVICES

 - SIGNAL PROCESSORS LOW-NOISE OSCILLATORS
 - CHANNELIZERS
- FERROELECTRONIC DEVICES
 - SENSORS
- LOW-NOISE/VIBRATION-IMMUNE CRYSTAL OSCILLATORS
- QUARTZ CRYSTAL RESONATORS NEW PIEZOELECTRIC DEVICES/RESONATORS
- MICROSENSORS

OBJECTIVE:

- DEVELOP ULTRA-STABLE, LOW NOISE FREQUENCY SOURCES AND CLOCKS FOR IFF, RADAR AND COMMUNICATIONS.
- PROVIDE ACOUSTIC-WAVE ANALOG SIGNAL PROCESSING DEVICES FOR REAL-TIME MULTIPLE EMITTER AND PASSIVE TARGET DETECTION IN HIGH DENSITY/HIGH-CLUTTER SIGNAL ENVIRONMENTS.



POWER SOURCES (INCLUDING PULSE POWER)

TECHNOLOGY AREAS OF INTEREST

- HIGH-RATE, HIGH-ENERGY, ENVIRONMENTALLY-BENIGN THROWAWAY BATTERIES
- HIGH-ENERGY RECHARGEABLE (MULTICAPABLE) BATTERIES
- ADVANCED ENERGY STORAGE CONCEPTS
- · HIGH-ENERGY, HIGH-REP RATE CAPACITORS
- HIGH-REP RATE, HIGH-ENERGY PULSER SWITCHES
- · HIGH-ENERGY PULSER COMPONENTS

OBJECTIVE:

- PROVIDE PORTABLE POWER FOR THE FULL RANGE OF ARMY EQUIPMENTS.
- IMPROVE PULSE POWER CONDITIONING COMPONENTS AND TECHNIQUES FOR DIRECTED ENERGY/KINETIC ENERGY WEAPONS, AND ELECTRIC DRIVES/ACTUATORS FOR COMBAT VEHICLES.

PROGE/010883/APBI(1-28-83)/257/SP



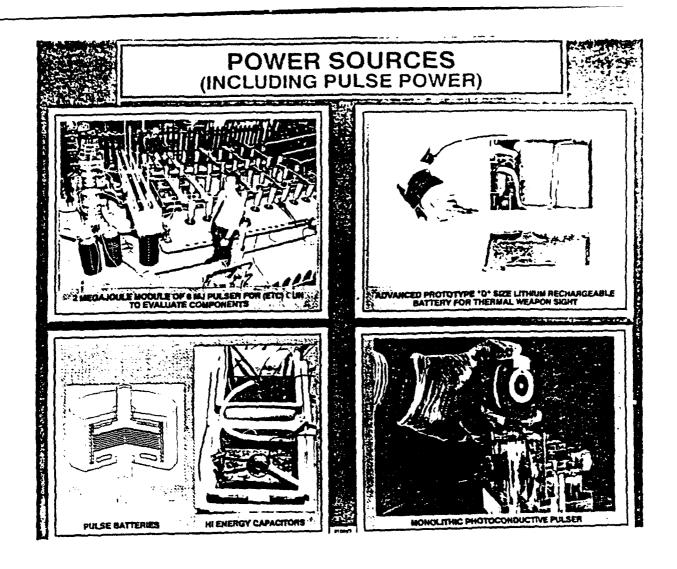
PROPOSED POWER SOURCES BAA



ELECTRONICS and POWER SOURCES

- LOW COST RECHARGEABLE PRIMARY BATTERY FOR GENERAL MILITARY APPLICATION
- RECHARGEABLE LITHIUM-LIKE BATTERIES (RLLB)
- IMPROVED MAGNESIUM BATTERIES
- PRIMARY BATTERY FOR SOLDIER SYSTEM, MAXIMUM ENERGY DENSITY
- PRIMARY BATTERY FOR SOLDIER SYSTEM, MAXIMUM POWER DENSITY

PP\$#AA#10181APBU1-14-03):5P



ELECTRONIC DEVICE RESEARCH

TECHNOLOGY AREAS OF INTEREST

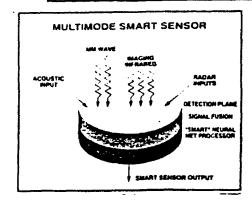
- . NANO/OPTO/PHOTOELECTRONIC DEVICES
- . OPTICAL MATERIAL/DEVICES AND FOCAL PLANE ARRAYS
- ADVANCED SENSORS AND ACTUATORS (MEMs)
- INFRARED DETECTOR TECHNOLOGY
- HIGH TEMPERATURE SUPERCONDUCTING DEVICES
- PERMANENT MAGNET DESIGN

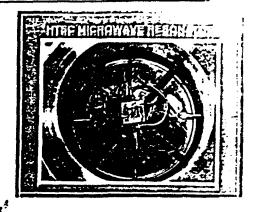
OBJECTIVE:

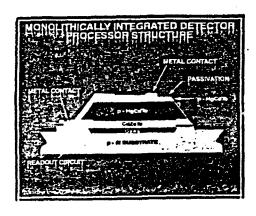
DEVELOP THE MATERIAL AND DEVICE TECHNOLOGY FOR NANO SCALE ELECTRONIC AND OPTOELECTRONIC DEVICES REQUIRED FOR HIGH FREQUENCY MICROELECTRONICS, RADAR AND OPTICAL SIGNAL PROCESSING. CREATE BOTH COOLED AND UNCOOLED INFRARED TECHNOLOGY FOR LOW-COST LARGE MULTI-COLOR INFRARED STARING ARRAYS. PROVIDE HIGH TEMPERATURE SUPERCONDUCTING DEVICES FOR RADAR RECEIVERS.

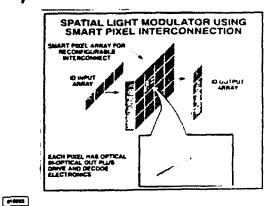
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ELECTRONIC DEVICE RESEARCH









EPSD SPONSORED CONSORTIA/COOPERATIVES

SUBJECT

- . LOG RAD COST REDUCTION
- METEOROLOGICAL DATA SYSTEM
- . SYSTEM DESIGN METHODOLOGY
- . TFEL COLOR DISPLAY
- . ULTRAPURE QUARTZ CRYSTAL
- . PRECISION OSCILLATOR
- . QUARTZ STUDIES
- MLRS MM WAVE TRANSCEIVER
- . DUAL MODE SEEKER
- SADARM MM WAVE TRANSCEIVER MM WAVE ANTENNAS
- . MM WAVE IMAGING RADARS
- . SATCOM-SCOTT TRANSMITTER
- . NOISE SOURCE FOR 94 GHZ
- . TANK DEFENSE RADAR
- . PARTS EMULATION
- HIGH PERFORMANCE DAC
- . VEHICLE SELF-PROTECTION
- * MIMIC HDL
 - . NEWLY FORMED

MEMBERS

- ATAT, TRW, ATI, INTERMETRICS, IBM, HONEYWELL, GOULD
- . TRW, SAWTEK, TRACOR, BENDEK, VIZ
- RTI, TELEDYNE BROWN, UVA, GTE, CSC, JERSEY CITY STATE COLLEGE
- . PLANAR, SARNOFF, SUPERTEX, NORDEN, ELDEC
- OK STATE U, LAWRENCE LIVERMORE LABORATORY, SAWYER RESEARCH
- . GE NEUTRON DEVICES, PIEZO TECH., INC.
- . PRINCETON U, RENSSELAER, MCI, RAYTHEON
- TRW, HUGHES, (MARTIN MARIETTA, DIEHL, THOMPSON CSF, THORN)
- . CHANG INDUSTRIES, NORTHROP, MICOM RDEC
- HONEYWELL, VARIAN, HUGHES, AEROJET, ALPHA, BALL AEROSPACE, TRW, FLAM & RUSSELL
- . WTD. MICOM RDEC
- STEINBRECHER, M-A/COM, HUGHES, FLAM & RUSSELL, GE E-LAB
- . NOISE COM, M-A/COM
- TACOM, TRW, TI, BALL, MILLITECH, MICOM, BRIL, HUGHES, GEORGIA TECH, PREDICTION SYSTEMS, CHANG INDUSTRIES
- . ITD. SYNOPSYS. QUICKTURN, SIGNETICS, GD
- . RADC
- . WID, MICON RDEC, ARMAMENTS RDEC
- . ESSOF, INTERMETRICS, PERIL

STERNUO10593.APBK(1-14-93)/SP



EPS LABORATORY IMPLEMENTATION OF THE TECHNOLOGY TRANSFER

ACT OF 1986
COUPERATIVE R&D AGREEMENTS (CROAS) IN EFFECT RESEARCH LABORATORY

ELECTR	ONICS	and POWER	SOURCES

		
PARTICIPANTS	AREA OF TECHNOLOGY TRANSFER	FOTE/SUB-FOTE
EPSD - ELECTROMAGNETIC SCIENCES	IUGH POWER MILLIMETER WAVE EVALUATION OF FERRITE DEVICES	ADV. ELECTRONICS/ M/MM WAVES
EPSD - TRONTECH	HIGH FREQUENCY OSCILLATORS AND AMPLIFIERS	ADV. ELECTRONICS/ NVMM WAVES
EPSD - AM. CYANAMID, EMCORE,	OMVPE GROWTH TECHNOLOGIES	ADV. ELECTRONICS/ M/MM WAVES
EPSD - MARTIN MARIETTA CORPORATION	MAGNETIC BLASING SYSTEM FOR MICROWAVE TUBES	ADV. ELECTRONICS/ NVMM WAVES
EPSD - MARTIN GOFFMAN ASSOCIATES	MILLIMETER WAVE SUPERCONDUCTOR DETECTORS	ADV. ELECTRONICS/ M/MM WAVES
EPSD - CECOM, BELLCORE	EPITAXIAL LIFT-OFF PROCEDURES FOR FIBER OPTIC APPLICATIONS	ABY ELECTRONICS/ M/MM WAVES
EPSD - NORDEN	FLAT PANEL DISPLAYS	ADV. ELECTRONICS/ DISPLAYS
EPSD - NEOCERA CORPORATION	SUPERCONDUCTOR TECHNOLOGY	ADV. ELECTRONICS/ M/MM WAYES
EPSD - MT	E-BEAM CIRCUIT ANALYSIS	ADV. ELECTRONICS/ DISPLAYS
EPSD - EMCTECHNOLOGY	PROGRAMMABLE MICROWAVE	ADV. ELECTRONICS SMICKOELECTRONICS
EPSD - ADVANCED LITHOGRAPHY GROUP	ION PROJECTION LITHOGRAPHY	ADV. ELECTRONICS/ MICROELECTRONICS



EPS DIRECTORATE IMPLEMENTATION OF THE TECHNOLOGY TRANSFER ACT OF 1986

COOPERATIVE RAD AGREEMENTS (CROAS) IN EFFECT (CONTINUATION)



US ARMY RESEARCH LABORATORY

ELECTRONICS and POWER SOURCES

PARTICIPANTS	AREA OF TECHNOLOGY TRANSFER	FOTE/SUB-FOTE
EPSD - ALPHA INDUSTRIES	PLANAR DOPED BARRIER DIODE TECHNOLOGY	ADV. ELECTRONICS/ M/MM WAVES
EPSD - ELECTRONIC CONCEPT, INC.	HIGH ENERGY DENSITY CAPACITOR TECHNOLOGY	POWER SOURCES
EPSD - SHIPLEY CORPORATION	DEVELOPMENT OF E-BEAM RESISTS	ADV. ELECTRONICS/ MICROELECTRONICS
EPSD - CECOM-RUTGERS UNIVERSITY	ULTRA-HIGH SPEED AND MM WAVE ELECTRONIC DEVICES	ADV. ELECTRONICS/ M/MM WAVES
EPSD - RUTGERS UNIVERSITY	FERROELECTRICS AND HIGH TEMPERATURE SUPERCONDUCTING THIN FILMS	ADV. ELECTRONICS/ M/MM WAVES
EPSD - RUTGERS UNIVERSITY	HERMETIC COATINGS FOR OPTICAL WAVEGUIDES	ADV. ELECTRONICS/ M/MM WAVES
EPSD - RUTGERS UNIVERSITY	SMART CERAMIC MATERIALS	ADV. ELECTRONICS/ M/MM WAVES
EPSD - CECOM-PRINCETON UNIVERSITY	PHOTONIC DEVICES	ADY. ELECTRONICS/ M/MM WAVES
EPSD - STEVENS INSTITUTE OF TECHNOLOGY	OPTOELECTRONIC DEVICES	ADV. ELECTRONICS/ M/MM WAVES
EPSD - N.J. INSTITUTE OF TECHNOLOGY	ULTRA-HIGH SPEED AND MM WAVE ELECTRONIC DEVICES	ADV. ELECTRONICS/ M/MM WAVES
EPSD - TECHTROL CYCLONETICS, INC.	LOW NOISE DIELECTRIC RESONATOR OSCILLATORS	ADV. ELECTRONICS/ N/MM WAVES

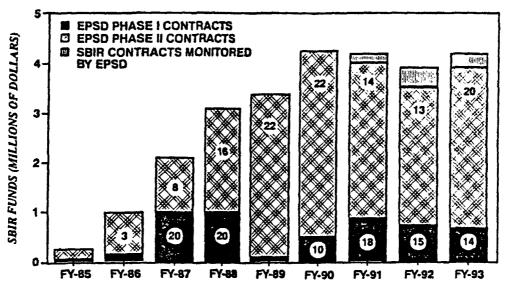
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EPSD - SBIR FUNDING



ELECTRONICS and POWER SOURCES



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ELECTRONICS AND POWER SOURCES LIST OF POC's

Fort Monmouth, New Jersey 07703-5601 Area Code (908) DSN (995/992)

DR. CLARENCE G. THORNTON Directorate Executive AMSRL-EP (908) 544-2541 (995)

MR. VINCENT ROSATI Program Coordination Office AMSRL-EP-C (908) 544-4651 (995)

MR. RICHARD STERN
Advanced Concepts and Plans
Directorate AMSRL-CP-TA
Technology-Transfer, Small Business,
SBIR Manager
(908) 544-4666 (995)

MS. REGINA R. VENEZIA
Operations Directorate
AMSRL-OP-PR-FM
Chief, Contracting and Acquisition
(908) 544-4919 (995)

MR. CHARLES D. BOYLAN Operations Directorate AMSRL-OP-PR-FM Competition Advocate (908) 544-3471 (995)

MS. MARY HAYES Advanced Technology Management Office AMSRL-EP-T Unsolicited Proposals (908) 544-4808 (995) MS. CAROL A. WIDMAIER
Advanced Technology Management Office
Information/Publications/Exhibits
AMSRL-EP-T
(908) 544-4808 (995)

DR. MICHAEL TOMPSETT Electronics Devices AMSRL-EP-E (908) 544-2452 (995)

MR. RANDOLPH A. REITMEYER Microcircuits Design and Components Division AMSRL-EP-I (909) 544-3465 (995)

MR. VALDIMIR GELNOVATCH Microwave/Lightwave Component Division AMSRL-EP-M (908) 544-4883 (995)

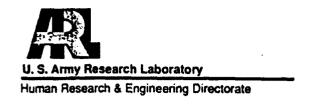
MR. JOSEPH KEY Reliability and Manufacturing Science Division AMSRL-EP-R (908) 544-4258 (995)

DR. ROBERT HAMLEN Power Sources Division AMSRL-EP-P (908) 544-2084 (995)

LABORATORY SEARCH Œ A R M Y



Dr. Robin L. Keesee Directorate Executive Human Research and Engineering (HRED) (410) 278-5800



Research Directions in ARL's Human Research & Engineering Directorate

REPORT DIRECT HIREC



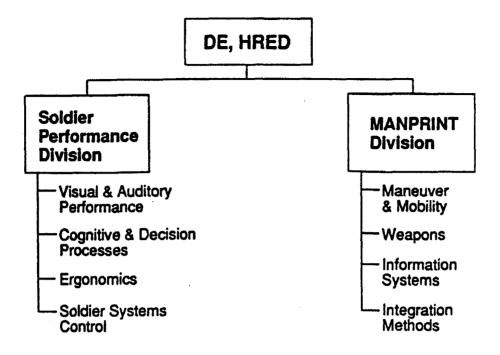
OUTLINE

- 1. The HRED Organization
- 2. Visual Search & Target Acquisition
- 3. Visual Control
- 4. Auditory Performance
- 5. Cognition and Decision Performance
- 6. Human Factors of the Individual Soldier
- 7. Crew Station Design
- 8. MANPRINT Manpower, Personnel, and Training Estimation
- 9. SBIR's
- 10. BAA's
- 11. Resource Distribution

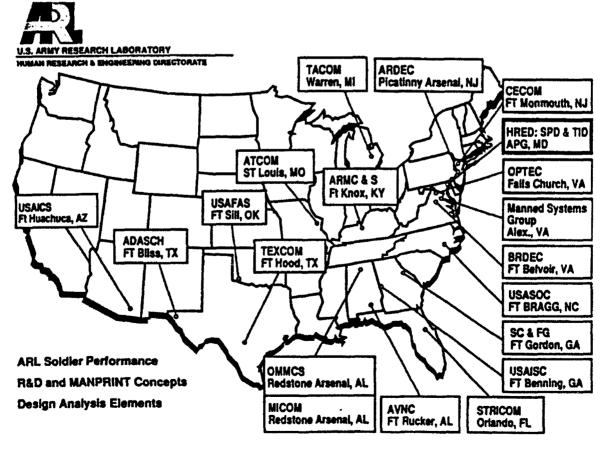
SACH DIRS DURING

U.S. ARMY RESEARCH LABORATORY HUMAN RESEARCH & ENGINEERING DIRECTORATE

HRED Structure



Rerch Dirs. HRED to (s)



MANPRINT DV Map Oct 92 (a)

HUMAN RESEARCH & ENGINEERING DIRECTORATE

MISSION

- Conduct broad-based program of scientific research and technology directed toward optimizing soldier performance and soldier-machine interactions to maximize battlefield effectiveness.
- Provide the Army and ARL with Manpower and Personnel Integration (MANPRINT) leadership to ensure that soldier performance requirements are adequately considered in technology development and system design.

Reich Dire, HRED to (s)



VISUAL SEARCH AND TARGET ACQUISITION

- Effect of Target and Scene Characteristics
 e.g. contract, size, shape, range and complexity
- Display Characteristics
 e.g. resolution, stereo, symbology, field of view
- Observer Characteristics
 e.g. training, experience, spatial and visual abilities

VISUAL CONTROL

- 1. Visual requirements for vehicular control
 - FOV
 - Resolution
 - Color
 - 3-D
- 2. Optimization of visual displays for special applications
 - Bandwidth limited teleoperations
 - Night, nap-of-the-earth flight
- 3. Enhancement of operator's capabilities and reduction of vision-driven workload
 - Perform multiple tasks
 - Control several vehicles

Rarch Dira, HRED 3 (s)



AUDITORY PERFORMANCE

U. S. Army Research Laboratory

Human Research & Engineering Directorate

1. Auditory Displays

Relates to enhanced transmission of information, situational awareness, design of warning and informational signals, etc. Should also be conceived of as symbiotically combined with visual displays.

2. Modeling and Empirical Verification of Auditory Target Detection, Identification and Localization

Important for stealth/low observable issues - includes both psychoacoustic as well as physical acoustic modeling and research.

3. Soldier/System Performance as a Function of Psychoacoustic Factors

e.g. - if I don't hear so well (because of wearing hearing protection or hearing loss or noise around me) how does this affect the time to fire, agree on IFF issues, detect the presence of the enemy, etc.

RSRCH DIRE.



Cognitive and Decision Performance

U. S. Army Research Laboratory

Human Research & Engineering Directorate

- 1. Predicting tactical decision making performance with decision aids
- 2. Measuring staff planning and command decision making performance at:
 - tactical level and
 - operating level
 - for logistics
 - maneuver
 - fire support
 - and other functional areas
- 3. Concepts for intelligent interfaces
- 4. Concepts for predicting soldier performance in unaided and aided materiel fault diagnosis

REACH DIRS. S



Human Factors of the Individual Soldier

U.S. ARMY RESEARCH LABORATORY

Human Research & Engineering Directorate

- Sensory Enhancement and Encapsulation:
 - Replacement of normal sensory modalities with the output of advance sensors (I2, IR, Audio and multimeter radar) thru advanced display media (Flat Plate and CRT).
 - Information display content, fidelity and control
- Motor and Strength Enhancement:
 - Kinematic degrees of freedom
 - Proprioceptive cueing
 - Force & speed feed back loops
 - Balance and gait constraints
- Virtual Environments:
 - Feasibility of VR and V interface technologies to improve system performance
 - Ergonomic adaptation of VR technologies for individual soldier interactions w/virtual environments
- Human Figure Modeling:
 - Analysis tool development compatible w/CAD/CAE and virtual environment simulations
 - Adaptation of HFM with Al attributes for inclusion of soldiers in the computer generated force environment

Aarch Dirs. HRED 6

Crew Station Design (CSD)

- Broaden & Improve Methods for CSD Process
- CSD for 50 Ton Tank
- Operator Control Units for Unmanned Ground Vehicles

MHE & PLS Enhancements

- MHE & PLS Enhancements
- Field Trials for FARV Resupply of LP Projectiles & Fuel to AFAS
- Control & Supervision of Robots & Precision Manipulators

REPORT DIRE. 7



MANPRINT Manpower, Personnel and Training Estimation

 Methods are needed for estimating operator and maintenance factors in automated information systems.



93.2 SBIR Solicitations Topics

- Fire Support Suppression Effects in Battlefield Simulation
- Human Performance Issues in Automatic Target Recognition and Situation Awareness Displays
- Development of Performance and Effectiveness Measures to Support Evaluations of Unmanned Ground Vehicles (UGV) Technologies and Operations
- Development of an Unmanned Ground Vehicle (UGV) Simulator

RISPICH DIRECT



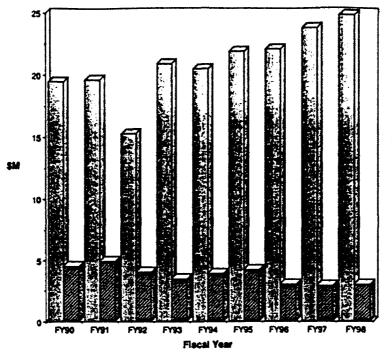
93 ARL BAA HRED Research Topics

- Simulation and Human Modeling
- Intelligent Decision Aids and Interfaces
- Human Information Processing
- Perceptual, Cognitive and Psychomotor Performance
- Knowledge-Based Reasoning
- MANPRINT Assessment Techniques for Maintenance Activities
- MANPRINT Integration Methods
- MANPRINT Design Analysis



Resource Distribution HRED Mission Funding \$ & Mission Contracts for FY90 - FY98 (Historical-Estimated)

HAMEN RESEARCH & Engineering Directories

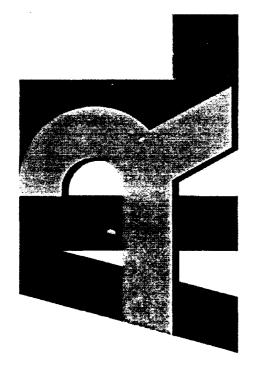


Note: Does not include Direct Cite Fund \$ or Direct Cite Contract \$

Names Clark HATECO 11 B

Funding Contracts

LABORATORY EARCH S Ш Œ Z C 4



Vehicle Structures

Dr. Wolf Elber Directorate Executive Vehicle Structures (VSD) (804) 864-3949

ARMY RESEARCH LABORATORY VEHICLE STRUCTURES DIRECTORATE

AT

NASA LANGLEY RESEARCH CENTER HAMPTON, VIRGINIA

BY

DR. WOLF ELBER

VEHICLE STRUCTURES DIRECTORATE DR. WOLF ELBER, DIRECTOR

Loads & Dynamics Division Dan Hoad, Acting Chief

Structural Dynamics
Application of Elastically-Coupled Structures
Smart Materials Application for Active Control
Crashworthy Design of Aircraft Structures
Structural Acoustic Wave Propagation
Interior Noise Reduction
Aeroelasticity (Rotorcraft Londs and Vibration)
Aeromechanical/Aeroelastic Stability
High-Speed Rotorcraft Vibration Reduction
Vaildation of Advanced Comprehensive Analyses
Active Control of Rotorcraft for Vibration Control

Vehicle Structures Division Dr. Feiton Bartlett, Acting Chief

Structural Integrity (Thick Composites)
Durability
Stress Analysis
Nondestructive Inspection
Advanced Design Methodology (Ground)
Structural Concepts
Optimization Methods
Structural Dynamics (Ground)
Smart Materials Application for Active Control
Interior Noise Reduction
Structural Dynamics Applications to Robotics

Structural Mechanics Division Dr. Felton Bartiett, Chief

Structural Integrity
Durability
Stress Analysis
Nondestructive inspection
Advanced Design Methodology
Structural Concepts
Optimization Methods

ARMY ~ NASA JOINT AGREEMENT

ARMY RESEARCH LABORATORY/NASA LANGLEY RESEARCH CENTER

PURPOSE: Joint participation in vehicle structures research

ARMY AGREES: Participate in rotary wing/structures research

Establish an Army Office Provide Army employees

Conform to all Langley operational requirements

SafetySecurity

- Work procedures

NASA AGREES: Make available facilities

Provide equipment, services, supplies, offices

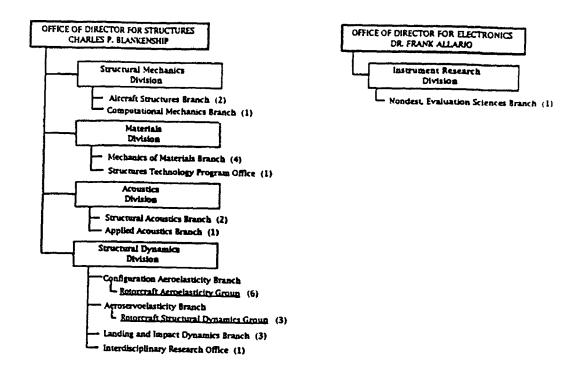
Publish research results

Provide necessary accounting information Provide contractual and personnel support

AERIAL VIEW OF

NASA LANGLEY RESEARCH CENTER

NASA LANGLEY RESEARCH CENTER PAUL HOLLOWAY, DIRECTOR



5-YEAR TECHNICAL THRUSTS

Structural Integrity

Provide integrated stress-strength-inspection technology for life-extension of existing and durability of future aero and ground vehicles

Advanced Design

Provide new ideas in composites/hybrid applications technology together with formal analytical design optimization tools

Structural Dynamics

Validate and refine analytical models for multi-body kinematics and dynamics to support vehicle loads analysis and vibration reduction

Aeroelasticity

Refine testing capability and analytical prediction methodology for vibration-free rotocraft designs

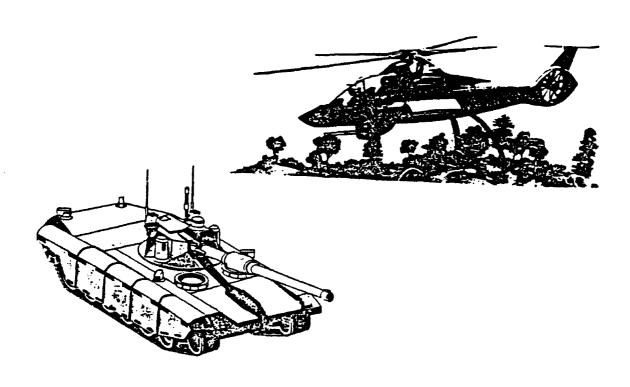
STRUCTURAL INTEGRITY THRUST

PROVIDE INTEGRATED STRESS-STRENGTH-INSPECTION TECH-NOLOGY FOR LIFE EXTENSION OF EXISTING AND DURABILITY OF FUTURE ARMY AVIATION AND GROUND VEHICLES

OBJECTIVES:

- ADVANCED STRUCTURAL ANALYSIS APPLICATIONS TO VALIDATE DESIGN TOOLS FOR COMPOSITE STRUCTURES
- COMPOSITE DELAMINATION FAILURE CRITERIA TO PREDICT ONSET AND PROGRESSION OF DAMAGE, FATIGUE DURABILITY, AND DAMAGE TOLERANCE
- ADVANCED NDE METHODS FOR FIELD INSPECTION AND MANU-FACTURING QA TO ENHANCE STRUCTURAL INTEGRITY AND TO REDUCE O&S COSTS OF ARMY VEHICLES

STRUCTURES TECHNOLOGY FOR AVIATION AND GROUND VEHICLES



ADVANCED DESIGN THRUST

PROVIDE NEW IDEAS IN COMPOSITES/HYBRID APPLICATIONS
TECHNOLOGY TOGETHER WITH FORMAL ANALYTICAL DESIGN
OPTIMIZATION TOOLS

OBJECTIVES:

- DESIGN, FABRICATE, AND TEST ADVANCED AIRFRAME STRUC-TURES TO ACHIEVE IMPROVED OPERATIONAL CAPABILITIES AT LOWER WEIGHT, LESS COST, AND INCREASED DURABILITY
- DEVELOP MANUFACTURING TECHNOLOGY WHICH MAKES
 THROUGH-THE-THICKNESS REINFORCED COMPOSITES COST
 EFFECTIVE TO PRODUCE WITH EXISTING TEXTILE MACHINERY
- DEVELOP OPTIMIZATION AND DISCIPLINE INTEGRATION
 TECHNIQUES INTO ROTORCRAFT DESIGN TO IMPROVE PRODUCT
 PERFORMANCE

PHOTO OF IMPACT DYNAMICS FACILITY

10

STRUCTURAL DYNAMICS THRUST

VALIDATE AND REFINE ANALYTICAL MODELS FOR MULTI-BODY KINEMATICS AND DYNAMICS TO SUPPORT VEHICLE LOADS ANALYSIS AND VIBRATION REDUCTION

OBJECTIVES:

- CONDUCT A COMPREHENSIVE TEST PROGRAM TO CHARACTER-IZE DAMAGE DEVELOPMENT IN SCALED COMPOSITE TENSILE COUPONS
- DEVELOP AND VERIFY SCALING LAWS FOR COMPOSITE MATE-RIALS AND LAMINATES TO IMPROVE SMALL SCALE TEST CAPABILITIES
- EVALUATE BENEFITS TO INTERIOR NOISE BY INNOVATIVE USE
 OF ACTIVE NOISE CONTROL AND ADVANCED MATERIALS
- DEMONSTRATE FEASIBILITY OF USING ENERGY ABSORBING COMPOSITE STRUCTURES BY MODIFYING METAL SUBFLOORS ON COMPOSITE AIRCRAFT

11

AERIAL PHOTO OF TRANSONIC DYNAMICS TUNNEL (TDT)

AEROELASTICITY THRUST

REFINE TESTING CAPABILITY AND ANALYTICAL PREDICTION
METHODOLOGY FOR VIBRATION-FREE ROTORCRAFT DESIGNS

OBJECTIVES:

- ENHANCE EXPERIMENTAL HARDWARE CAPABILITY IN THE TRANSONIC DYNAMICS TUNNEL (TDT) TO IMPROVE VERSATIL-ITY AND EFFICIENCY OF MODELING ADVANCED ROTORCRAFT.
- DEVELOP ANALYTICAL AND EXPERIMENTAL TOOLS TO UN-DERSTAND AND MINIMIZE FIXED AND ROTATING SYSTEM HELICOPTER VIBRATORY LOADS.
- VALIDATE FINITE ELEMENT PREDICTION (MSC-NASTRAN) OF MODAL PROPERTIES OF EXISTING TOT ROTORCRAFT ROTATING SYSTEMS.

13

VEHICLE STRUCTURES DIRECTORATE TECHNOLOGY TRANSFER OPPORTUNITIES

1992 Tech Transfer Meeting
(Over 50 Industry/Academia/Government Attendees)

IR&D Plans/Reviews
(Rotorcraft and Ground Vehicle Industry)

VSD's Quadchart Program Descriptions

Cooperative Research & Development Agreements (Six in Place)

PHOTO OF SMOKE TEST IN TUNNEL

15

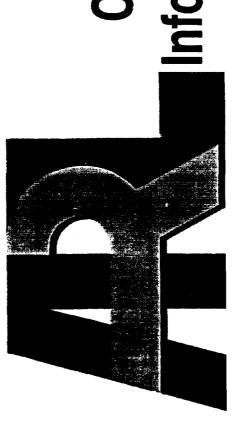
SUMMARY

Joint Army-NASA Agreement gives Army maximum research capabilities at minimum cost

VSD pro-active in technology transfer efforts (Tech Transfer Office)

Research opportunities expanding

LABORATOR ESEARCH <u>~</u> ARMY



Advanced Computational & Information Sciences

Dr. Andrew Mark
Chief (acting)
Simulation Technology Division
Advanced Computational and
Information Sciences Directorate (ACIS)
(410) 278-9760



Advanced Computing, Simulation & Software

Briefing to Industry

Presented By

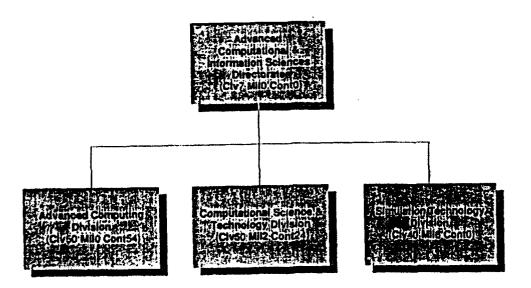
Dr. Andrew Mark
Chief, Simulation Technology Division
Advanced Computational & Information
Sciences Directorate

ARMY RESEARCH LABORATORY



Organization

ACISD





Thrusts

ACISD

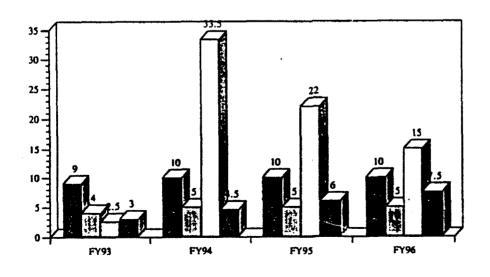
- * High Performance

 Computing/Communications
- * Software Technology
- * Simulation Technology



Projected ACIS Budget

HIGH PERFORMANCE COMPUTING



- RESEARCH
- O&M
- ☐ ACQUISITION
- CONTRACTS

Technical Areas



ACISD

High Performance Computing/Communications

Vector & Massively Parallel Processing Local and Wide Area HP Networks Distributed Computing Scientific Visualization

Software Technology

Artificial Intelligence
Expert Systems
Information Systems
Information Distribution Technology
Simulation Technology

Technology and Material/Materiel Assessment
Virtual Factory
Virtual Reality for the Individual Soldier
Louisiana Maneuvers



Unique Facilities

SOFTWARE TECHNOLOGY

Existing

- Cray-2 Vector Processor
- Cray X-MP/48 Vector Processor
- Touchstone Gamma Machine
- Various Mini/Superminis (Convex, Digital, Encore, etc.)
- · Access to CM-200, CM-5
- · ASNET, DISNET, ARLNET

Soon to be Realized

- · Access to major vector processor (unclassified)
- Upgrade to major vector processor (classified)
- · Scalable MPP with novel architecture
- DREN



High Performance Computing/Communication

HIGH PERFORMANCE COMPUTING

LONG RANGE GOALS:

- Develop technology in the form of strategies, techniques, algorithms, and the assessment of architectures to provide high performance computing for the solution of scientific and engineering problems of interest to ARL, AMC and the Army.
- Provide ARL and the Army with state-of-the-art computational capability, particularly in classified and massively parallel processing.
- Make significant contributions to the President's initiative on Strategic Computing.
- Provide ARL and the Army with state-of-the-art high speed technical data communications.



High Performance Computing Project Details

HIGH PERFORMANCE COMPUTING

High Performance Computing

- Objective: To best position the ARL and the Army to understand, assess, acquire and exploit the best large scale scientific computer technology for application to problems of interest and concern to the technology base.
- · A diverse set of activities.
- Provides funding for:
 - · Classified and unclassified visualization centers,
 - · Collaborative efforts with U. of Md. (CM-2),
 - · Undergraduate program in HPC at Howard U.,
 - · CEM and CFD codes with Industry Partners,
 - · Collaborative efforts with AHPCRC (SciVis, MPP),
 - · Collaborative efforts with DOE labs (MESA, PAGOSA, CTH, PCTH),
 - · Collaborative efforts with DARPA (iPSC/860, NCHPC),
 - General MPP and HPC support to Directorates of ARL and RDEC's of AMC.



Programs in HPC/C

HIGH PERFORMANCE COMPUTING

DoD HPC/C Modernization Program:

Replace existing SC assets with stable systems
Acquire early access to advanced systems
Establish HPC-Networking Capability
Provide Tri-Service prepaid computing

Infrastructure to support HPC/C and Distributed Computing

Army High Performance Computing Research Center



Specific HPC/C Programs

HIGH PERFORMANCE COMPUTING

Acquire Stable Systems:

FY93/4 - Network-Robotic Mass Storage - \$1.5M

FY94 - Replacement Classified System - \$30M

FY95 - Augmentation ~ \$15M

Acquire Early Access Systems:

FY94 - BAA for Scalable Architectures - \$2.5M

FY95 - BAA for Scalable Architectures ~ \$5M

Establish DRLN Networking Capability:

FY93 - Phase I - \$6M

FY94 - Phase II ~ \$10M

POC: Mr. Tony Pressley ATTN: AMSRL-CI-A Army Research Laboratory Aberdeen Proving Ground, MD 21005-5067 (410) 278-6509 FAX (410) 278-5077



Basic Research - ARO Program

SOFTWARE TECHNOLOGY

- Provides 6.1 funding for basic research in mathematics and computer science to support High Performance Computing Initiative.
- Provides the funding and contract monitoring support for the Army High Performance Computing Research Center (AHPCRC).
- Provides the infrastructure for proposal review, contract awards, and contract performance monitoring in the area of basic research.
- Research topics are most general and include algorithms, data structures, high level languages, etc.



Software Technology

SOFTWARE TECHNOLOGY

LONG RANGE GOALS:

- Provide the Army and ARL with research into state-of-the-art information systems software products and modernized software systems.
- Develop distributed group decision support systems.
- Devise and apply expert systems to Army applications.
- Perform research into and apply Information Distribution Technology to Army systems.
- Develop scientific computing algorithms for scalable parallel architectures.



Programs in Software Technology

SOFTWARE TECHNOLOGY

- Experiments in information distribution technology with high level applications
- Re-engineering research program
- · Research in collaborative work environments
- MPP algorithm development
- Specific-applications for expert systems



Specific Projects in Software Technology

SOFTWARE TECHNOLOGY

ACTS/IDSN Satellite Experiment

FY93 - Evaluate commo capability - \$0.2M

Group Decision Support Systems

FY93 - Apply consolidated system to ARL ~ \$0.3M

FY94 - Develop distributed GDSS ~ \$0,4M

Re-engineering

FY93 - Select significant system for re-engineering - \$0.2M

FY94 - Complete re-engineering demo - \$0.2M

POC: Dr. James Ganté ATTN: AMSRL-CI-CD Army Research Laboratory 115 O'Keefe Building Georgia Institute of Technology Atlanta, GA 30332-0800 (414) 894-3104 FAX (414) 894-3142



Simulation Technology

SIMULATION TECHNOLOGY

LONG RANGE GOALS

- Develop a capability for the assessment of materiel/materials and novel technologies in a simulated battlefield environment through a Technology Assessment Center.
- Develop valid, verified physical and engineering models for the evaluation of advanced and emerging ARL technologies in wargame settings.
- Perform research into physical and process models to enable the development of a virtual factory.
- Develop and create a virtual environment for the individual soldier which will enable technology development and training.



Programs in Simulation Technology

SOFTWARE TECHNOLOGY

- Technology Assessment Center
- Tech Base Seminar Wargames
- I-PORT (Individual Portal into Simulation)
- Louisiana Maneuvers
- Virtual Factory
- Virtual Environments for ARL



Specific Projects in Simulation

SOFTWARE TECHNOLOGY

Virtual Factory

FY93 - Composite Materials R&D Modeling - \$0.3M

FY93 - Matrix Metals R&D Modeling - \$0.3M

FY94 - Weapon Component Mfg Process Modeling ~ \$0.5M

Virtual Environments

FY93 - Hardware for simulation - \$1.4M

FY94 - Develop simulation environment - \$1.0M

The Louisiana Manuevers (ARL Support)

FY93 - Weather simulation, KBLPS, etc to LAM ~ \$1.0M

FY94 - Other ARL products to LAM ~ \$1.0M

Design the 93 TBSWG - \$1.0M

POC: Dr. Kurt Fickie ATTN: AMSRL-CI-S Army Research Laboratory Aberdeen Proving Ground, MD 21005-5067 (410) 278-6858 FAX (410) 278-5075

POC: Dr. Andrew Mark ATTN: AMSRL-CI-S Army Research Laboratory Aberdeen Proving Ground, MD 21005-5067 (410) 278-6858 FAX (410) 278-5075



Cooperative and Collaborative Programs

SOFTWARE TECHNOLOGY

- National Consortium for High Performance Computing
 - NCIIPC = DARPA <-> DoD Labs <-> Industry <-> Academe
- Virtual Factory
 - ARL <-> U. of Del. <-> U. Minn <-> Industry
 - · CRADA's between ARL & Industry

POC: Mr. Harold Breaux ATTN: AMSRI_CI-A Army Research Laboratory Aberdeen Proving Ground, MD 21005-5067 (410) 278-6259 FAX (410) 278-5077 POG: Dr. Kurt Fickie ATTN: AMSRL-CI-S Army Research Laboratory Aberdeen Proving Ground, MD 21005-5067 (410) 278-6858 FAX (410) 278-5075

LABORATORY I EARC Ш S Œ ARMY



Dr. Jack Wade Directorate Executive (acting) Survivability/Lethality Analysis (SLAD) (505) 678-1196 (410) 278-6342

MISSION

Survivability/Lethality Analysis Directorate

- Determine the survivability and lethality of Army systems to the full spectrum of battlefield threats:
 - Ballistic
 - Electronic Warfare
 - Nuclear
 - Chemical and Biological
 - Directed Energy



GOALS AND OBJECTIVES

- Understand how systems function in a *multi-threat* environment.
- Enhance system survivability and lethality through the application of the best available technology.
- Provide technical assistance to Army managers and decision makers throughout the system acquisition process.

MAJOR FUNCTIONS

Survivability/Lethality Analysis Directorate

- Conduct investigations, laboratory and field experiments, simulations and analyses to quantify system survivability and lethality.
- Provide objective judgements on complex technical issues regarding system survivability and lethality.
- Serve as the Army focal point for technical advise and consultation on survivability and lethality issues.
- Conduct studies and make recommendations regarding design and/or operational techniques to enhance system survivability/lethality.



DIRECTORATE ORGANIZATION

Survivability/Lethality Analysis Directorate Office of the **Directorate Executive** Dr. Jack Wade (A) 410-278-6342 (APG, MD) 505-678-1196 (WSMR, NM) Integration Office Dr. Michael Starks 410-278-6628 (APG, MD) **Ballistic Vulnerability** Electronic Warfare Nuclear, Biological and Division Lethality Division Chemical Effects Division COL George Lasche Or. Paul Deitz Mr. Mike Miller (A) 505-678-2256 (WSMR, NM) 410-278-6282 (APG, MD) 410-671-8421 (APG, MD)

PROGRAM EXECUTION CONCEPT

Survivability/Lethality Analysis Directorate

- System analyses planned and executed through an integrated analysis team (IAT) process.
- Threat and technical disciplines will be integrated at the working level instead of at the system management level.
- Current IAT structure:
 - Air Defense
 - Aviation
 - C4/IEW
 - Ground Systems
 - Munitions



MODELS/SIMULATIONS

- Ballistic Component and Compartment
- Stochastic Component (SQUASH)
- Stochastic Processor of Artillery Effectiveness (SPRAE)
- Army Unit Resiliency Analysis (AURA)
- Surface-to-Air Missile Sites Mean Area Effectiveness (SAMSMAE)
- Non-Uniform Simple Surface Evaporation (NUSSE)
- EPLRS/MSE System Performance
- EOCM missile flight simulation
- Open-loop Tracking Complex
- Air-to-Surface Missile Simulation
- Anti-Tank Guided Missile Simulation
- Electromagnetic coupling

UNIQUE FACILITIES/CAPABILITIES



Survivability/Lethality Analysis Directorate

- SEMIVAF (WSMR)
- Millimeter Wave Measurement Facility (WSMR)
- BIG CROW (Kirtland AFB)
- Combat Vehicle Ballistic Range (APG)
- Aircraft Ballistic Vulnerability Experimental Facility (APG)
- Smoke Week



TECHNICAL AREAS

Ballistic Vulnerability/Lethality Division

- Vulnerability analysis:
 - Armored systems
 - Air systems
- · Lethality analysis:
 - Anti-armor and artillery munitions
 - Air defense systems
- · Armor/anti-armor concepts evaluation.
- Live Fire/Joint Live Fire ground and air systems.
- · Geometric and materiel modeling.
- Computer aided vulnerability/lethality analysis.
- Advanced computer technology.
- · Analysis of unit level operations.
- Personnel vulnerability analysis.
- Spare parts requirements predictions.
- Foreign materiel exploitation.



INDUSTRY OPPORTUNITIES

Ballistic Vulnerability/Lethality Division

Survivability/Lethality Analysis Directorate

- Vibrational analysis and wind tunnel testing of helicopters with damaged rotor blades.
- · Formulation of algorithms for flight dynamics analysis.
- Evaluation of flight dynamics and controllability of aircraft with damaged flight controls and/or surfaces. (Video output showing aircraft behavior)
- · Generation of geometric target descriptions.
- Develop database to catalog and annotate existing vulnerability data.
- Conduct sensitivity analyses to determine the influence of component PK/H quality on analysis results.



TECHNICAL AREAS

Electronic Warfare Division

- Electronic warfare vulnerability assessment (EWVA):
 - Theoretical analyses
 - Laboratory measurements
 - Field experiments
- Signature measurements:
 - Spatial, spectral, and temporal
 - RF, IR, visible, acoustic and seismic
 - U.S., threat targets, and countermeasure devices
- Electronic warfare support:
 - EW environments
 - Data acquisition, processing and analysis
 - Simulators/emulators
 - Known, expected and reactive threats

TECHNICAL PROGRAMS

Electronic Warfare Division

Survivability/Lethality Analysis Directorate

- Programs which may require industry support include:
 - Missile defense
 - Air defense
 - Aviation
 - Close combat
 - C41
- Programs range form small to large and include:
 - National/Theater Missile Defense GBI/GBR, THAAD, PAC-3
 - Commanche, Longbow Apache
 - C41 ATCCS, MSE, SICPS, CHS
 - Mines FASCAM, WAM
 - Munitions BAT, SADARM
 - JSTARS



INDUSTRY OPPORTUNITIES

Electronic Warfare Division

- Engineering services to support ongoing EWVA.
- Improved analysis tools, techniques, methodologies.
- Computer virus protection concepts.
- Concepts to effectively make multi-spectral measurements.
- Concepts/approaches to measure signatures in all three (spatial, spectral and temporal) dimensions simultaneously.
- Wavelet coupling theory.
- High power microwave diagnostics and antenna characterization.

INVESTMENT STRATEGY



Survivability/Lethality Analysis Directorate

- 80 % of mission funding (6.5) to be allocated to systems analyses through the SLA process.
- 20 % of mission funding (6.2) to be used to develop tools, techniques and methodologies in direct support of system analysis efforts.
- Customer funding (PEO/PM, RDEC, etc.) to be used to support specific customer requirements.



FINANCIAL OUTLOOK

- Mission funding: \$50 million per year.
- Customer funding: \$15 \$20+ million per year.
- Internal costs: approximately 85 % of total funding. (Includes approximately \$20 million for multi-year support contracts.)

TECHNICAL AREAS

Nuclear/Biological/Chemical Effects Division

Survivability/Lethelity Analysis Directorate

- PEO/PM support:
 - Program management
 - Technical and analytical
 - Expert system development
- Database development and management.
- Chemical Defense Materials Database.
- Materials test methodology development.
- Smoke/obscurant effectiveness studies.
- · Smoke Week.
- · Agent dispersion models.
- · Analysis methodology development.
- Electromagnetic coupling models.
- Soldier vulnerability.



INDUSTRY OPPORTUNITIES

Nuclear/Biological/Chemical Effects Division

- Multi-disciplinary analytical support (blast/thermal radiation, initial nuclear radiation, electromagnetic pulse, and chemical/biological) for planned efforts in air defense, aviation, C4I, ground systems and munitions.
- Support to PEO/PM:
 - Awareness training
 - Expert system (s)
 - Program management tools/documentation

POINTS OF CONTACT

Survivability/Lethality Analysis Directorate

• General Information: Dr. Jack Wade, 410-278-6342 or 505-678-1196

Dr. Michael Starks ,410-278-6828

Army Research Laboratory, AMSRL-SL-I Aberdeen Proving Ground, MD 21005-5001

• Ballistics:

Dr. Paul Deitz, 410-278-6282

Army Research Laboratory, AMSRL-SL-B Aberdeen Proving Ground, MD 21005-5001

• Electronic Warfare: Directed Energy

COL George Lasche, 505-678-2256 Army Research Laboratory, AMSRL-SL-E White Sands Missile Range, NM 88002-5513

· NBC:

Mr. Mike Miller, 410-671-8421

Army Research Laboratory, AMSRL-SL-N Aberdeen Proving Ground, MD 21010-5423

FY 93 ADVANCE PLANNING BRIEFING U.S. ARMY RESEARCH LABORATORY **FOR INDUSTRY**

OPERATIONS DIRECTORATE PROCUREMENT DIVISION

INFORMATION PACKET JANUARY 28, 1993 WHITE OAK, MD

U.S ARMY RESEARCH LABORATORY FY 93 ADVANCE PLANNING BRIEFING FOR INDUSTRY

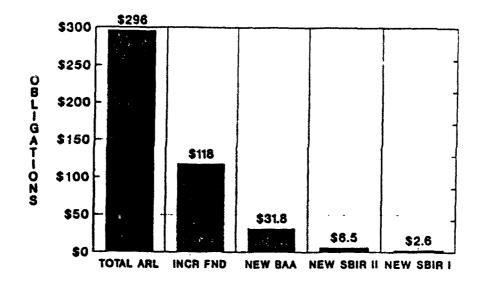
OPERATIONS DIRECTORATE PROCUREMENT DIVISION

INFORMATION PACKET JANUARY 28, 1993 WHITE OAK, MD

FY 93 ACQUISITION PLAN ARL SUMMARY

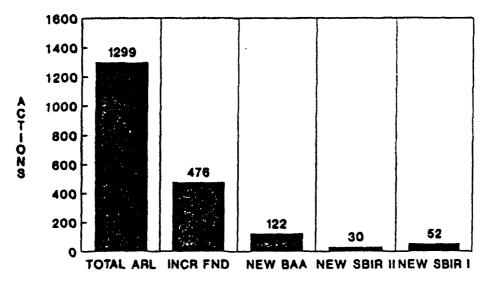
- TOTAL ESTIMATED OBLIGATIONS: \$296 MILLION, 1299 PLANNED PROCUREMENT ACTIONS
- OF THIS AMOUNT, 476 ACTIONS AND \$118 M!LLION ARE INCREMENTAL FUNDING MODIFICATIONS
- THE PLAN INCLUDES 52 NEW SBIR PHASE I CONTRACTS, ESTIMATED AT ABOUT \$2.6 MILLION
- ARL PLANS 30 NEW SBIR PHASE II CONTRACTS, ESTIMATED OBLIGATION OF ABOUT \$6.5 MILLION
- ARL PLANS 122 NEW BAA CONTRACTS, ESTIMATED OBLIGATION OF ABOUT \$31.8 MILLION

FY 93 ACQUISITION PLAN ARL SUMMARY



ESTIMATED OBLIGATIONS IN MILLIONS

FY 93 ACQUISITION PLAN ARL SUMMARY



NUMBER OF ACTIONS

RECURRING ARL CONTRACT REQUIREMENTS

CONTRACTOR: DESCRIPTION:

General Dynamics Corp., Ft. Worth, TX Design, Fabrication, and Maintenance

of SADS

CONTRACT AMT: **EXPIRATION DATE:** COMPETITIVE:

\$4,661,849 052293 YES

CONTRACTOR:

Colsa Inc., Huntsville, ALA

DESCRIPTION: CONTRACT AMT: Engineering Support for FMD ATGM

EXPIRATION DATE: COMPETITIVE:

013093 **UNKNOWN**

\$2,493,272

CONTRACTOR: DESCRIPTION:

Optimetrics, Inc., Ann Arbor, MI

Measurement Support

CONTRACT AMT: **EXPIRATION DATE:** COMPETITIVE:

\$2,946,909 083194 UNKNOWN

RECURRING ARL CONTRACT REQUIREMENTS

CONTRACTOR:

Regents of NMSU, Las Cruces, NM

DESCRIPTION:

Air Defense & Space Systems EW Support

CONTRACT AMT: **EXPIRATION DATE: 063095**

\$9.930.760

COMPETITIVE: CONTRACTOR: UNKNOWN

DESCRIPTION:

Syndetix, Inc. Las Cruces, NM Engineering Services and Materials

CONTRACT AMT: EXPIRATION DATE: 041595

\$3.344.537

COMPETITIVE:

YES

CONTRACTOR:

Science & Technology Corporation

Hampton, VA

DESCRIPTION:

Directed Energy & Electro-Optical Atmospheric Research Support

CONTRACT AMT:

\$\$30,550,860

EXPIRATION DATE: 100394

COMPETITIVE:

YES

RECURRING ARL CONTRACT REQUIREMENTS

CONTRACTOR:

Concurrent Computer Corporation

Richardson, TX

DESCRIPTION:

Computer Maintenance of FMMS System

CONTRACT AMT:

\$155,206.92 093097

EXPIRATION DATE:

YES

COMPETITIVE:

DESCRIPTION:

CONTRACTOR:

Management Assistance Corp of America

Financial/Administrative Management

Information Services, El Paso, TX

CONTRACT AMT:

\$3,251,206

EXPIRATION DATE:

093094

COMPETITIVE:

YES

CONTRACTOR: DESCRIPTION:

Regents of NMSU, Las Cruces, NM Scientific, Engineering and Technical

Support Services

CONTRACT AMT:

\$8,478,412

EXPIRATION DATE:

063094 **UNKNOWN**

COMPETITIVE:

RECURRING ARL CONTRACT REQUIREMENTS

CONTRACTOR:

Geocenters, Inc. Newton Centre, MA

DESCRIPTION:

Equipment and Facility Maintenance \$4,474,093

CONTRACT AMT: EXPIRATION DATE:

011894

COMPETITIVE:

UNKNOWN

CONTRACTOR:

Vitronics, Inc. Eatontown, NJ

DESCRIPTION:

On site operation and maintenance

support of laboratory equipment

CONTRACT AMT:

\$5,629,029 011795

EXPIRATION DATE: COMPETITIVE:

UNKNOWN

CONTRACTOR:

General Technical Services, Inc.

Wall Township, NJ

DESCRIPTION:

Technical & Administrative Support Service

CONTRACT AMT:

\$803,415

EXPIRATION DATE: 061495 COMPETITIVE:

UNKNOWN

RECURRING ARL CONTRACT REQUIREMENTS

CONTRACTOR:

Vitronics, Inc. Eatontown, NJ

DESCRIPTION:

Equipment, test bed & facility operation

and maintenance support services

CONTRACT AMT: EXPIRATION DATE: \$1,941,039

COMPETITIVE:

093095 **UNKNOWN**

CONTRACTOR:

Applied Dynamics International

Ann Arbor, MI

DESCRIPTION:

Hardward & Software Maintenace

CONTRACT AMT:

\$150,157.50

EXPIRATION DATE: COMPETITIVE:

093095 NO

CONTRACTOR: DESCRIPTION:

Compatible Micro Solutions, El Paso, TX ADP Services to develop, maintain and

utilitze software & hardware tools

CONTRACT AMT: **EXPIRATION DATE:**

\$609.921 043095

COMPETITIVE:

NO

ARL PROCUREMENT SITE FORECAST OBLIGATIONS

FORT WHITE SANDS MONMOUTH WATERTOWN **ADELPHI** \$22.2 \$89.5 \$22.1 \$92.7

FY 93 SMALL BUSINESS FORECAST

SMALL BUSINESS

\$54.6M(28%)

SMALL DISADVANDAGED BUSINESS \$11.7M (6%)

USING THE ARL BROAD AGENCY ANNOUNCEMENT (BAA)

Each attendee at this conference will receive a copy of the ARL BAA (FY93). The ARL BAA is a comprehensive listing of research and development topics of interest to ARL technical directorates. You are encouraged to review this document and submit proposals for those topics that are of interest to you. Each topic in the BAA lists a technical point of contact. You may contact them with any technical questions. Non-technical questions regarding the BAA should be directed to:

> Henry J. Mehler Army Research Laboratory ATTN: AMSRL-OP-PR-WT Watertown, MA 02172-0001 (617)923-5005